The FOUNDRY

Volume 48. No. 24
Whole No. 361

Published
Semimonthly

CLEVELAND, OHIO, DECEMBER 15, 1920

Air Furnace Iron for Big Castings

Electric Company Uses Both the Cupola and the Air Furnace in Its Big Gray-iron Foundry—Condenser Molds Made in Pits with Skeleton Patterns and Green-sand Cores

BY H. E. DILLER

CUPOLAS almost universally have been adopted as the melting medium in gray-iron foundries because they furnish satisfactory metal at the lowest cost. Simplicity of operation and efficiency due to the metal absorbing heat directly from the fuel explains this low melting cost. However, this proximity between the metal and the fuel militates against securing the highest grade of metal from the cupola. Being in direct contact with the coke of the charge the iron absorbs sulphur given up by the coke and it also retains all the carbon the iron will hold. If the iron charged into the cupola is not saturated with carbon some of the element is taken up from the coke and conversely if the iron of the charge is supersaturated some of this carbon is given up until equilibrium between the metal and the metalloid is reached. Small amounts of steel in the mixture will not make any difference in the total amount of carbon in the melted iron due to this tendency of the charge to absorb from the coke. Even with large precentages of steel in the mixture, satisfactory results are not attained in lowering the amount of carbon in the metal because under different melting conditions the metal will acquire varying amounts of carbon from the coke.

Even with these handicaps the cupola furnishes an excellent quality of metal which is used in the most delicate castings and nearly every gray-iron foundry has adopted it. However, the majority of iron roll foundries and a few others melt iron in air furnaces. A consideration in adopting this melting medium besides that of quality of metal, is the large body of hot metal which may be tapped at one time. With the cupola a considerable wait is necessary between the time the first metal appears until enough is melted to pour a large casting. This prevents a close regulation of the pouring temperature of cupola metal, which is so essential for many castings.

Some foundries are equipped with both cupolas and air furnaces and get the advantages of both, using the cupolas where possible to keep down melting costs and the air furnaces for castings requiring special grades of iron. The foundry of the Westinghouse Electric & Mfg. Co., located at Lester, Pa., one of the manufacturing suburbs of Philadelphia, is an example of such an establishment. This foundry has four cupolas—three lined to 66 inches and one to 48 inches—as well as two 40-ton and one 15-ton air furnaces. The air furnaces are used for the larger castings and where special high-grade

WHEN the average foundryman thinks of gray iron he thinks of the cupola as the melting medium, for only a comparatively few have had experience with the air furnace. However, this furnace finds an important place in roll foundries and in a few others where a large quantity of metal is wanted at one time. Large amounts of hot homogeneous metal which can be closely controlled with regard to composition is its chief recommendation. Therefore, a description of this melting medium as it is used in one of the foundries of the Westinghouse Electric & Mfg. Co. is of interest to many, describing, as it does, the charging and melting process and citing the class of work into which the iron is poured.

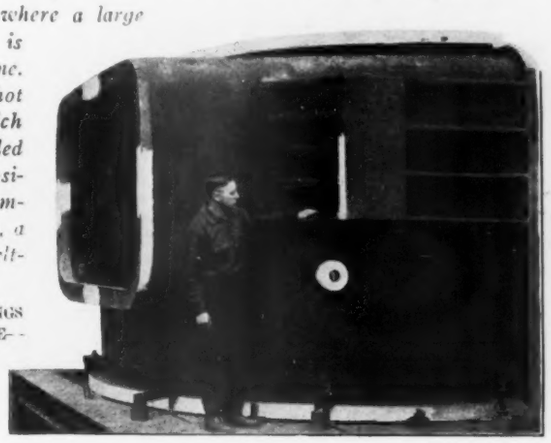
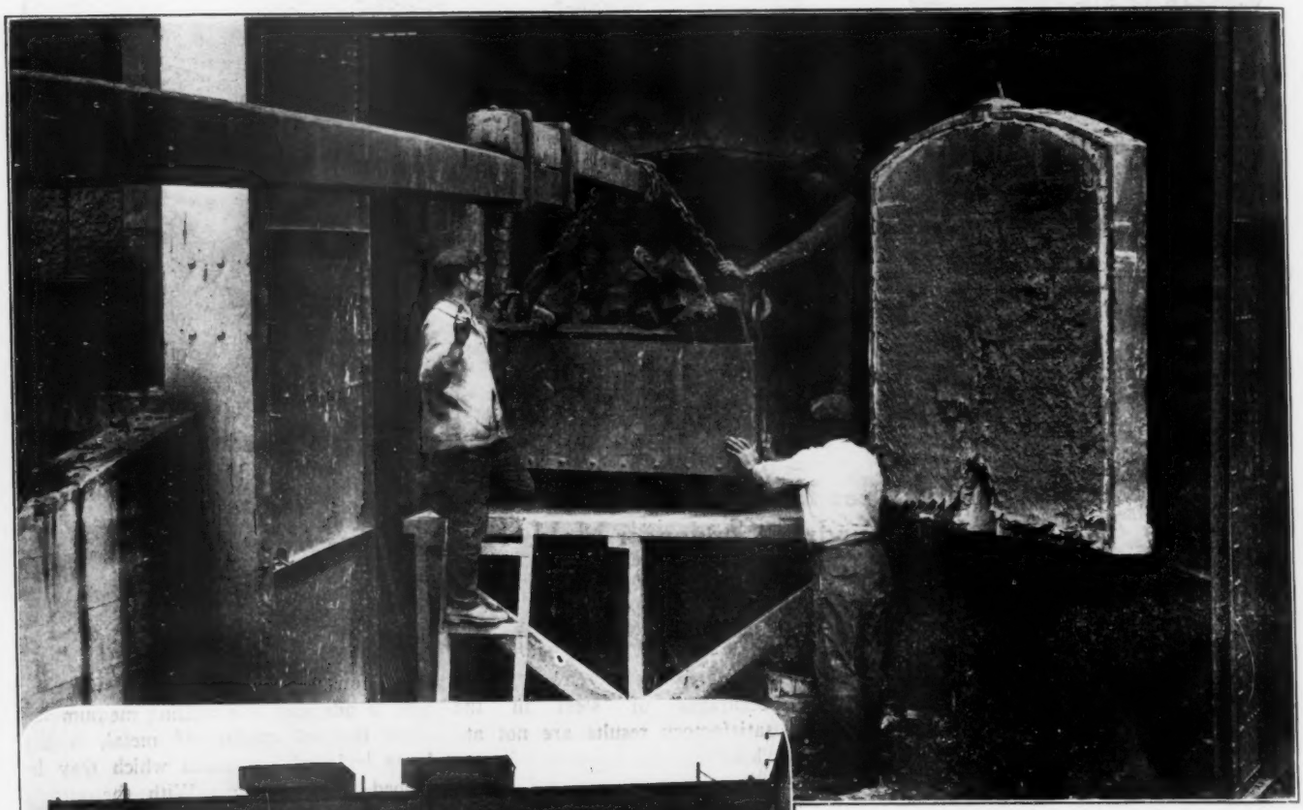


FIG. 1—CONDENSER CASTINGS WEIGH 15 TONS OR MORE—THIS ONE IS 8 FEET HIGH AND HAS AN INSIDE DIAMETER OF 16 FEET 10 INCHES



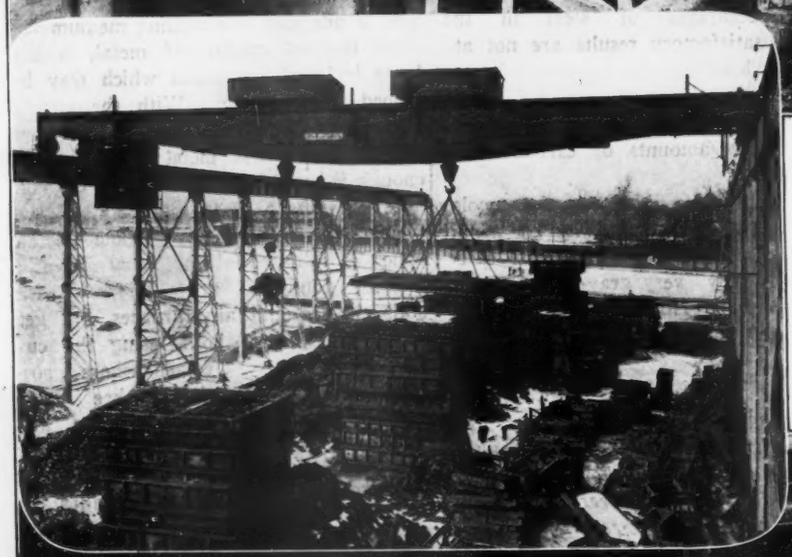


FIG. 2—PIG IRON AND SCRAP ARE PLACED INTO THE FURNACE WITH A BOOM CARRIED BY THE CRANE FIG. 3—A CRANE WITH A 100-FOOT SPAN TRAVELS ALONGSIDE OF THE FOUNDRY, COVERING THE FLASK AND STOCK YARD—FIG. 4—IN BROKEN-BACK FURNACES THE ROOF NEAR THE FIRING BOX IS LOWER THAN THE PORTION NEAR THE STACK

metal is required. As all three furnaces with a total rated capacity of 95 tons may be tapped at the same time and each may be charged in excess of its rated capacity, it is possible to secure more than 100 tons of hot metal at one time. That the capacity of the air furnaces is at times required is evidenced by the fact that the Westinghouse foundry is equipped to pour castings requiring 150 tons of metal.

The furnaces at Lester are of the broken-back type in contrast to the furnaces at the company's plant at Trafford City, Pa., which are of the straight back style. Using both these types of air furnaces the company has an opportunity to observe the advantages of each design. The straight-back furnace is the more easily charged and has the advantage that the roof stands up longer not being cut as quickly by the flame. On the other hand, it is less efficient as a melting medium than the broken-back type. A view looking into the broken-back furnace, Fig. 4 shows how a portion of the roof is lower than the remainder. The workman is cleaning the bottom after the heat has been tapped the previous day. As a new bottom must be made after each heat, not more than one heat can be taken off in a day. After the slag is cleaned from the bottom, a layer of burned core sand from the cleaning room is spread over the surface and smoothed off. The floor then is covered with 1-inch boards to prevent the metal when charged from digging into the sand and forming pockets which would hold the molten metal. This floor, of course, is sloped towards the tap hole. The metal is charged through a large door which forms the entire end of the furnace. This door which is handled on a jib attached to a steel column at the side of the furnace, swings in a semicircle. This arrangement may be noted in Figs. 2 and 4.

The fire box is at that end of the furnace opposite to the one shown. The flame coming across the interior of the furnace is brought close to the metal by the low roof. After passing through the higher part of the furnace the gases pass out the flue in the front of the furnace, shown directly behind the workman with the shovel. This flue leads to the stack which is beside the furnace instead of being directly in line with it as is the general custom in air furnaces for malleable work. The stack of each furnace is built to produce sufficient draft without the use of blowers and no forced draft is needed.

Stock is charged by a large boom carried by the traveling crane which covers the flask and stock yard. This crane has 60 tons capacity and a runway 600 feet long with a 100 foot span. It is equipped with a lifting magnet and is used to handle flasks as well as to care for the stock. The boom will charge large heavy pieces of metal or will deliver a large box filled with pig iron as shown in the illustration. The method of placing the charge has been found to be quite important. It must be so arranged that the flames have a clear sweep through the furnace and penetrate completely around the large chunks. To secure this effect, pigs are laid on the bottom of the furnace, longitudinally with the direction of the flame. The heavy pieces then are laid on the pigs which keep them off the bottom of the furnace and allows the gases to pass under them. They also are laid with their long axes in the direction in which the gases pass and are placed in that portion of the furnace nearest to the fire box. Pig iron is stacked near the large door of the furnace and also in the portion underneath the stack. It is also stacked along the sides, but is kept 10 inches from the walls. In piling the pig iron three pigs are laid parallel on the bottom of the furnace with a little space between the pigs. Then another layer of three pigs is placed across the first row at right angles to it. Eight or ten such layers are continued one on the other. This method of piling gives the gases of combustion a chance to come in contact with a large percentage of the surface of each pig.

After all the metal has been placed in the furnace the charging door is closed and luted with a mixture of clay and sand. The two steel doors, shown at both sides, Fig. 2, which separates the furnace inside the building from the stock yard outside the building also

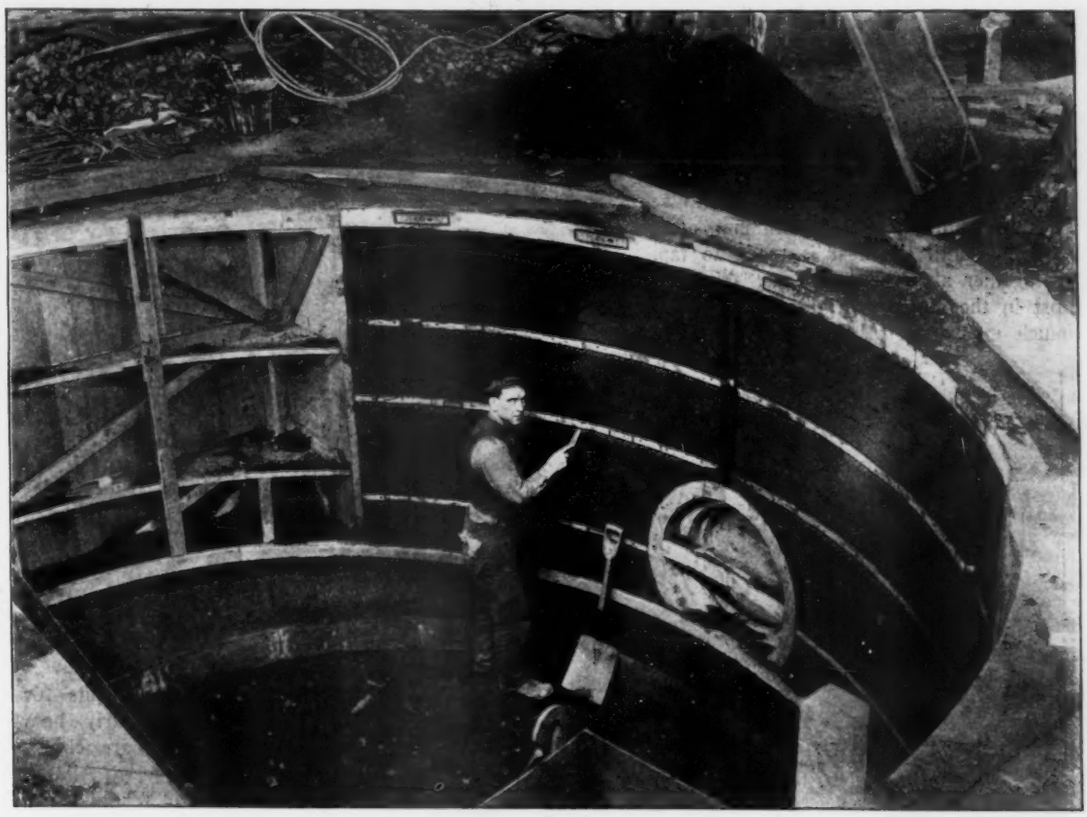


FIG. 5—WHEN THE PATTERN IS REMOVED THE MOLD IS SLICKED AND STRIPS THE THICKNESS OF THE METAL ARE ATTACHED ALONG THE SIDE BEFORE THE CORE IS RAMMED

are shut. A fire is then started with gas coal and the metal soon begins to melt. Enough pig iron is melted, before the pigs under the heavy pieces melt, to form a bath of metal into which the heavy stock falls when the pigs under it are melted. As soon as the charge is entirely melted, a preliminary test is poured for silicon determination. About an hour is taken to secure the results of this test. Then the metal in the furnace is manipulated to secure the desired amount of silicon in the finished metal. If the silicon is low when the metal is melted additions are made with ferrosilicon. If the test shows 1.45 per cent silicon and 1.65 per cent is wanted in the finished metal, enough ferrosilicon is added to theoretically bring the silicon contents of the bath up to 1.75 per cent because 0.10 per cent silicon is lost by oxidation from the time the preliminary test is taken until the heat is ready to tap. Altogether about *0.30 per cent* silicon is lost in the entire operation. Almost as much manganese also is lost, the exact amount depending largely on the percentage in the original charge. When the manganese is too low in the bath, ferromanganese is added to secure the required percentage in the metal. Carbon likewise is burned out to a considerable extent so that the metal usually contains from 3.00 to 3.20 per cent total carbon when ready to tap, notwithstanding no steel is added to lower the carbon. The average 40-ton heat is ready to tap approximately 11 hours after the fire has been lighted. The temperature of the metal as it comes from the air furnace is about the same as that tapped from the cupola, but the air-furnace product is more homogeneous and has lower total carbon and sulphur. Because little sulphur is picked up by the charge in melting in the air furnace a large proportion of scrap can be carried in the mixture without unduly raising the sulphur contents in the metal. Sometimes as much as 80 per cent of the charge is scrap metal.

The Westinghouse company believes the air furnace iron is cleaner and freer from slag inclusion than is cupola iron. It shrinks less internally than cupola iron and tends to form a more homogeneous casting, though its contraction is slightly greater. The average heat contains 1.65 per cent silicon, 0.065 per cent sulphur, 0.50 per cent phosphorus, 0.50 per cent manganese, and 3.00 to 3.20 per cent total carbon.

Iron runs from the furnaces in long troughs which end over pits for holding the ladles. Two of these pits each 15 feet in diameter and 10 feet deep serve the three air furnaces. While the furnaces are located in a side bay, the pits are at the edge of the center bay and the large cranes in this section carry the ladles of metal to the molds.

The foundry is divided into a center bay and two side bays. The center bay which has an 80-foot span is served by two 60-ton and one 100-ton cranes, besides being equipped with three 5-ton wall cranes on each side. The two side bays also are well equipped with cranes. Both are 60 feet wide and one has three and the other two traveling cranes of 25 tons capacity.

Not only is the foundry well equipped with cranes, for handling large work, but the floor has a number of large concrete pits for the molds required in particularly heavy castings. Some of these are circular and others are rectangular. All the pits are 10 feet deep and the two circular pits are 16 feet in diameter. One of the rectangular pits is 16 x 20 feet and the other two pits are 20 x 64 feet. These pits are ingeniously arranged so that they may be divided into sections of varying lengths. This is accomplished by setting cast iron division plates against angle irons secured every five feet in the concrete side walls. In this way a pit may be made of any length in multiples of five feet up to the full length of the pit.

The Westinghouse company has realized that patterns are the most essential feature of heavy work. Full cooperation between the pattern shop and the foundry is secured by constant conferences between the general foremen of these two departments which is possible because the pattern shop and foundry building are practically connected.

Skeleton patterns are used to a large extent and many of the large cores are made on arbors in green sand. An illustration of the molding methods as

FIG. 7—THE PATTERN FOR THE CONDENSER FRAME IS PUT INTO THE PIT AND LOOSE PIECES ARE ATTACHED WITH WOOD PINS

FIG. 6—THE CRAB, OR AREOR FOR THE CORE IS MADE OF CAST-IRON PLATES BOLTED TOGETHER —AFTER THE CORE IS RAMMED THE ARPOR AND CORE ARE LIFTED FROM THE PIT WITH A CRANE

well as of the extent of the work produced in this foundry is shown in Figs. 5, 6, 7 and 8. These indicate progressive steps in four molds for condenser shell castings, being made simultaneously. All of these molds are made in the two long 64-foot pits which were divided into the proper length to accommodate the molds. The general form of these castings may be noted in Fig. 1 which shows one half section of a shell on a planer bed, with the side down which is up in the mold. This condenser shell is 8 feet high and 16 feet 10 inches in diameter. It is made in two sections, metal when the core of the mold is made. One of these strips may be seen inserted in the mold at *A*, Fig. 6, and directly above it are shown a pile of strips ready to be placed.

In this particular casting these strips are 1¼ inches thick. The strips extend from the upper frame to the lower one slightly below the waist of the molder standing in Fig. 5, and being straight from the semi-circumference of a cylinder. They are attached to the frames by screws. Below the strips the mold curves in to form the shoulder of the casting. After the core has been with-in place and the runner boxes, made in sections in cast-iron forms, are put on. The mold is then weighted and bolted down.

A mold all ready to pour is shown in Fig. 8. A cast-iron cross bar, *A*, is placed to form a chord on the semi-circular runner box, and serves to stiffen the box and to lift it after the casting is poured. A portion of the runner box may be seen at each end of this bar, *A*. The mold is poured from three basins. Two of these are at the ends of the mold and the other is in the center. A basin at one end of the mold is shown at *B*.

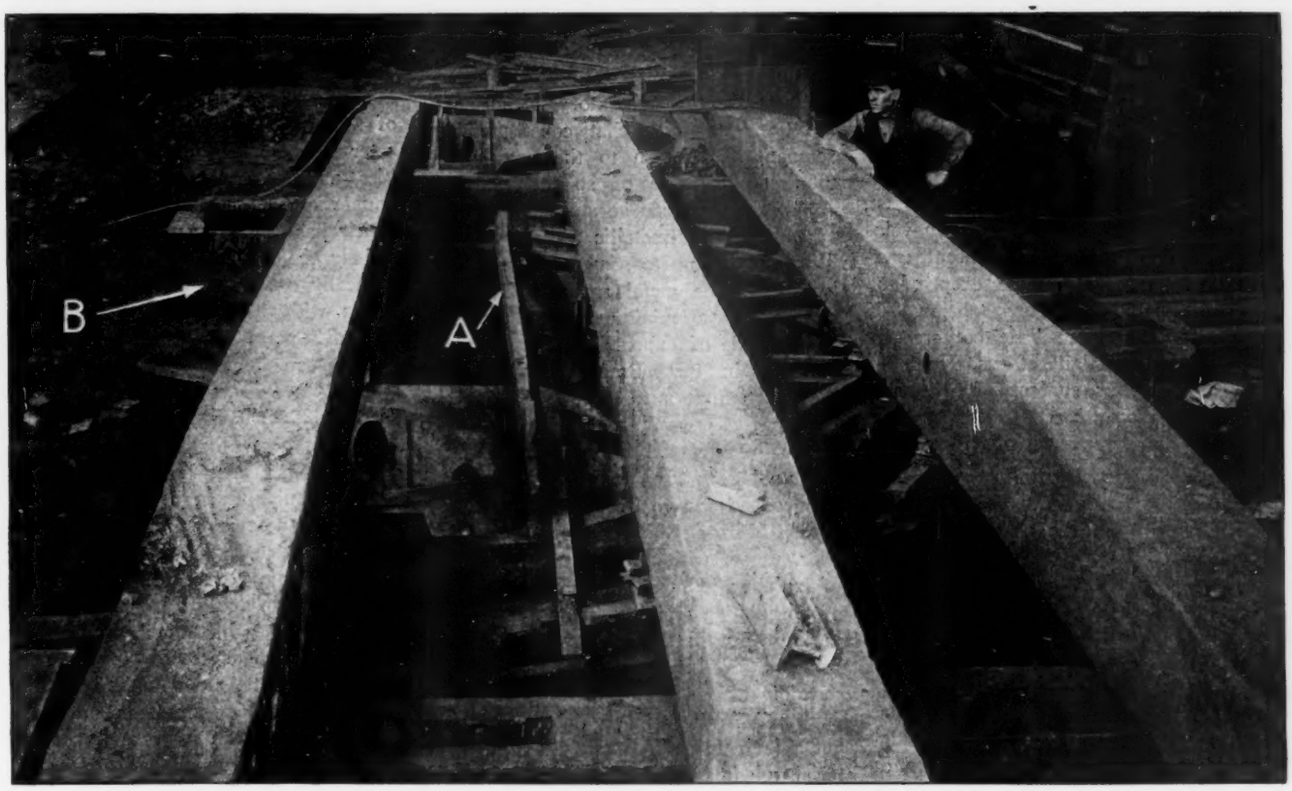


FIG. 8– CONDENSER-FRAME CASTING POURED FROM A GATE AT EACH END UNTIL THE METAL FILLS THE MOLD TO THE TOP OF THE CURVED SIDE AFTER WHICH IT IS POURED FROM A SEMICIRCULAR RUNNER BOX

the one shown in Fig. 1 weighing 24,800 pounds in the rough. There is a slight variation in the shape of the two sections but the same molding principle is applied to each.

Fig. 7 shows the pattern after it is first put into the sand, with a few of the loose pieces attached to it by wooden pins. Sand is rammed on the outside of this pattern by pneumatic rammers and is backed up with gagger rods. This semi-circular pattern is split at an acute angle along the center of the cross piece, *A*, instead of at an angle of 90 degrees. This arrangement greatly facilitates the work of lifting the pattern which does not need to be rapped. After the pattern is drawn by the crane the mold is slicked, Fig. 5, and strips are inserted around the circumference to give the thickness of drawn this lower portion of the mold is swept.

The core is made on a cast iron crab or arbor. Part of one of these arbors is shown in place in Fig. 6. As may be noted this is made in sections bolted together. Plates are bolted through the smaller holes shown in the plates, in place, and extend at right angles to these toward the edge of the core. After all the strips are secured about the mold, the core is rammed with sand, stiffened with gagger rods and backed by coke to aid venting. When the core finally is rammed, the arbor with the core is lifted from the pit by the crane and the loose pieces removed. The core and mold are then finished. The mold is skin dried with salamanders, and the core is skin dried in the oven. Then the core is set

Fig. 8. The basins at the ends of the mold connect to the bottom of the mold through runners. Iron is poured into these basins first and as soon as enough metal is in the molds to fill it to above the lower portion which has a curved side as shown in Fig. 8 iron is poured into the center basin and no more is poured through the end gates. The iron runs from the center basin into the semi-circular runner box. This has fifty ¾-inch holes, in the bottom, through which the iron drops directly into the metal in the mold, which has been poured through the end gates. About an hour after the mold has been poured, the nuts on the arbor are released and the arbor is then free to allow the casting to contract. The weights and runner boxes also are taken away at this time and the casting is allowed to cool.

The Sulphur Problem in Cast Iron

The Sure Tendency of Sulphur to Segregate Constitutes the Greatest Menace of High Sulphur—The Basic Electric Furnace Often Produces Sulphur Far Below 0.05 Per Cent

BY GEORGE K. ELLIOTT

THE chief count against sulphur in cast iron seems to be that it is a nonmetal preempting a place among real metals, a bold pretender, a counterfeit. This it has been able to do by taking on the semimetallic semblance of the sulphide of a metal; but all the time the foundryman has never lost sight of the fact that sulphur in the form of a sulphide, be it iron sulphide, or manganese sulphide, still is a non-metal and not entitled to an important or vital place in the metal structure.

In plain unfigurative language, sulphides in cast iron break up the metallic continuity of the mass by freezing last, thereby being enabled to collect in veins along the joints between adjacent crystals of iron. This is true even of so small amounts of sulphur as below 0.05 per cent; but we are little bothered or concerned by so slight effects. However, when the sulphur content of cast iron gets to be more than 0.05 per cent it shows a most remarkable tendency to segregate in spots in a way that is liable to increase the harmful effects beyond all numerical proportion. By this it is meant that 0.15 per cent sulphur will harm cast iron through the increased tendency to segregate, more than three times as much as will 0.05 per cent sulphur. The writer's estimate would be that the evil would aggregate at least three times three times. It is this sure tendency to segregate that in my judgment constitutes the greatest menace of high sulphur. Occasionally there is a foundryman learned, experienced and clever enough to make occasional high sulphur iron castings in which the sulphur is uniformly distributed throughout the metal; in such cases there always is widespread wonder at the unexpectedly good quality of the metal so rich in sulphur. Here the word *good* is used advisedly and only relatively. Except when certain well defined qualities such as hardness are required and can be attained by no other means, a low-sulphur iron will outshine a high-sulphur one when the full inventory of really worthy qualities is taken. By low sulphur in the preceding sentence I mean *practical* low sulphur of 0.05 to 0.075 per cent, or sulphur scant enought to be incapable of *serious* segregation.

However, the basic electric furnace process often produces sulphur so far below 0.05 per cent that the question is raised as to the advantages accruing from sulphur as low as 0.020 per cent, for example. In this connection I can recall one heat that emerged from the tandem process with the sulphur so far eliminated that it took a gravimetric analysis in the laboratory to discover the 0.009 per cent that constituted the remnant To return to the question as to the advantage of so low sulphur. Academically it can be answered that the amount of non-metallic intercrystalline film breaking up to some extent the solidarity of the metal mass, is definitely reduced to a minimum that formerly was capable of expression only on paper and not in fact. Practically answering the question, it must be admitted freely that in the present state of testing and measuring the qualities of cast iron, we are unable to fix positively any pronounced advantage in gray iron castings with 0.015 or 0.030 per cent sulphur, over those with twice those amounts of sulphur. However, there is a sort of speculative satisfaction and assurance in knowing that limits can be and are being achieved in every day practice that certainly are safe beyond all shadow of doubt; that the danger line at least is put a long way off. Possibly a more material advantage in this extremely low sulphur is the fact that the degree of desulphurization can be taken as a very reliable gage of the amount of general refining that has taken place in the metal bath, having in mind particularly deoxidation and degasification.

Another rather indirect but very significant benefit derived from low sulphur in cast iron is a certain independence from high or moderately high manganese. One of the reasons for the presence of this last element in cast iron is the neutralization of the evil effects of sulphur, through preventing the formation of pernicious iron sulphide by forming manganese sulphide in its stead. Frequently iron is overdosed with manganese merely to take care of anticipated high sulphur and not seldom is the surplus manganese sufficient to increase the hardness and correspondingly decrease the machinability of the castings. If the metal is known to be very low in sulphur, the manganese may be used more sparingly, with a saving not only of manganese but of machine shop finishing costs. The fact has indeed been noticed that electric furnace refined iron with low sulphur will be harder than cupola iron of the same silicon, combined carbon and manganese content and higher sulphur. This probably is because the manganese, relieved almost entirely of the charge of policing that bad character sulphur, is released to other activities and so goes to work forming double carbides with iron and carbon, which has the effect of increasing materially the hardness of the metal. Theoretically one part by weight of sulphur unites with 1.7 parts of manganese to form 2.7 parts of manganese sulphide; that is, sulphur at 0.12 per cent will unite with 0.20 per cent manganese to form 0.32 per cent manganese sulphide. Assuming then that we have an iron with 0.80 per cent manganese and 0.12 per cent sulphur, at most only 0.60 per cent manganese is available to form carbide and harden the iron. If, however, the sulphur is reduced to 0.02 per cent, there is needed only 0.034 per cent manganese to take care of it, leaving 0.766 per cent manganese to form carbide. This represents an actual increase in manganese carbide of over one-fourth Surely, so great an increase is not without some effect upon the hardness. To retain no more than the manganese-carbide-bestowed hardness of the original iron having 0.80 per cent manganese and 0.12 per cent sulphur, the manganese would need to be only about 0.63 per cent in the case where the sulphur is reduced to 0.02 per cent. In this connection the author is called upon to say that differences in hardness such as are illustrated in the preceding example probably would not be measurable or even noticeable in large castings, but are distinctly manifest in small ones. Also this question of hardness is intermingled with the closely related subjects of the increased attraction of high-manganese irons for carbon and of the protective influence of high manganese against oxidation in the cupola, both of upon the subject of hardness and sulphur.

From a paper presented at the 25th annual convention of the American Foundrymen's association held in Columbus O., the week of Oct. 4-8, 1920. The author, George K. Elliott, is connected with the Lukenheimer Co., Cincinnati.

Instead of striving for an accomplishing the low sulphur limits that have just been mentioned it is entirely probable that the more popular practice will be to resort to the use of more scrap or of pig irons running higher in sulphur. For example, making mixtures coming from the cupola with 0.120 to 0.150 per cent sulphur or even more, and by duplexing in a basic electric furnace reducing that element about one-half. In the finer grades of iron foundry work so great a reduction of sulphur as this would show benefits that would be practically demonstrable. It is undeniably possible to improve the general qualities of really high-sulphur cast iron by desulphurization. The more abundant widespread use of scrap is rapidly becoming not only an economic duty for the sake of the conservation of our raw materials but also in this time of high freight rates, a well defined need. Here we have a distinctly useful application of the basic electric furnace for rendering scrap fit for service that is normally more or less unfit on account of its accumulation of sulphur.

The chief process used for desulphurizing iron and steel in the electric furnace may be set down in the chemical reaction

$$FeS + CaO + C = Fe + CaS + CO$$

or

$$MnS + CaO + C = Mn + CaS + CO$$

It is quite probable that the full reaction or sequence of reactions is more complex than here shown although the given reaction does truly represent the essential outline of what takes place. The reaction means that the sulphur is removed from the metal bath as calcium sulphide which is soluble in the slag and not in the iron. A reducing condition is necessary for the success of the reaction, for were the furnace atmosphere oxidizing in nature, the calcium sulphide would quickly be converted into sulphate and as such in turn would react with the iron to form more iron sulphide which was the original compound of the sulphur in the iron and so would reenter the bath. From the reaction we see that carbon is required in addition to the lime in the slag; indeed the presence of some calcium carbide (CaC_2) in the slag is a required security that the bath is in the essential deoxidized condition without which the elimination of sulphur is impossible. This is made by throwing powdered coke over the not too thick or viscous slag covering the bath.

The reducing or deoxidizing nature of the reaction by which desulphurization is accomplished in this electric furnace process should be emphasized. By it getting rid of sulphur is made a double blessing; and who knows what and how many of the virtues of basic electric furnace iron are in reality due not only to low sulphur but also and perhaps to a much greater degree, to the chemically *deoxidizing* influences by which it has been refined?

Returning Competition Demands Action

STEEL salesmen today are coming into their own once more. For four or five years the art of salesmanship as applied to iron and steel products has been at a discount. The unprecedented demand for these products, when the federal government for war purposes was not taking all the mills and furnaces could turn out, left the salesman little to do. No sooner was a mill free to sell than presto, every pound of material product was sold, in many times even before the mill salesman could turn around. In fact, about all that the steel salesman has been doing in the past several years has been to smooth out the ruffled feelings of customers who were not getting deliveries as fast as promised. He has been the buffer between his own mill and oftentimes irate customers who wanted what they wanted when they wanted it, threatening dire things "when the shoe gets on the other foot." The sales office has been the scene of some lively times when such customers have dropped in and made their position plain, sometimes in emphatic language when they thought they were "getting the worst of it." And the salesman often had to think mighty rapidly and clearly to find a way to pacify them.

Now, however, the shoe is decidedly on the other foot. Today the mills and furnaces, the foundries, and machine shops want business and want it badly, most of them. The cutting of the almost entire price schedule from pig iron and coke through to wire and plates is one move of producers to encourage consumers to place business with them. But mere price-cutting does not run the gamut of the art of salesmanship; it is only one of the many attributes. Placing a lower price schedule before the eyes of a hesitating buyer than of competitor can show is the errand of an office boy because the headwork is done further back along the line. But to persuade that reluctant buyer by convincing argument of better service higher grade material and finish, prompter delivery and the presentation of the thousand and one of the arts of better salesmanship calls for the exercise of mental equipment that comes only through deep study of one's own mill conditions, the customer's needs, general trade conditions the railroad situation as to deliveries, freight rates and such important details which only the experienced salesman carries about with him.

Considerable interest, therefore, has been aroused in the trade by the rumor that certain iron and steel concerns contemplate reducing their force of salesmen. It would appear that if these salesmen are experienced, now is the very time when their services will be needed if ever. These are the days when every order taken counts two, because only about so much business has come out into the open, and like in one big pot, every order booked leaves just that much less for other mills to scramble for. Steel orders today appear to be in just one big pot and the most active salesman is he who can dip just that many times faster and land just that much more for his concern.

The most active salesman needs all the help these days his company can give him to land the business. The very best because the most effective aid his company can give is through the medium of active, discriminating and worthwhile advertising. Any man who thinks he is "saving money" by relaxing in the least in his advertising activities is putting just that many hindrances and stumbling blocks in the way of his sales force, making their work just that much harder.

Keep your salesmen busy and give the conscientious salesman every bit of help that your advertising experience can command. Thus you will back him up and fortify him in the way he and you deserve. You will find this one of the soundest pieces of business advice you have followed in years. These are the days of real salesmanship—and not mere order takers.—*The Daily Metal Trade.*

The capitalization of the Hill & Griffith Co., 1262 State avenue, Cincinnati, manufacturers of foundry supplies, recently was increased from $150,000 to $200,000.

The Austin Co., Cleveland, recently established 10 district offices and warehouses and a number of subsidiary offices to handle its contractors' machinery.

Fig. 1—Finished Piston Core

Problems Encountered in Gas Engine Castings

BY PAT DWYER

Fig. 2—Another View of Piston Core

IT sometimes is a difficult point to determine just where pure science leaves off and practical application begins. They merge into each other so gradually that the scientist is apt to carry his investigations and experiments farther than is necessary in a specific case, to overlook the point he set out to investigate and regard the results of his experiments as the ultimate goal instead of a basis from which to draw conclusions. The practical man, on the other hand, is inclined to scoff at the efforts of the scientist and claim that whatever measure of success he may achieve is directly due to hard work combined with a fair measure of common sense. As a matter of fact the growth and improvements in methods in any industry are due to the combined efforts of practical and scientific men. The latter analyzes and investigates, he wants to know the why and the wherefore, he takes things apart and puts them together again and forever is interested in forming new combinations. In many cases the practical application of his theories are placed in the hands of other men, and if some unexpected difficuty arises it must be solved in a practical way. Take the question of chemical analysis for instance. Theoretically any two irons having the same composition should be identical and produce the same kind of casting when remelted. However, it is a well known fact that this theory is not always borne out in practice.

The trouble with chemical analysis is that while it is a fairly reliable guide, it is never complete and therefore not infallible. Investigations carried on and tests taken from time to time have resulted in indicating the relative proportions of the component parts entering into the composition of pig iron, which would be most suitable for different classes of castings, but if it is found that castings conforming to this analysis are not measuring up to the required physical standard it is quite apparent that some other factor will have to be investigated in order to produce satisfactory castings.

A case in point is the practice pursued at the plant of the Rathbun-Jones Engineering Co., Toledo, O. This company specializes in the production of high grade gas and oil engines up to and including 1000 horsepower. The castings are made, machined, assembled, set up and the complete engine tested to its full capacity before it is shipped. In this way a close check is kept on the quality and appearance of the castings.

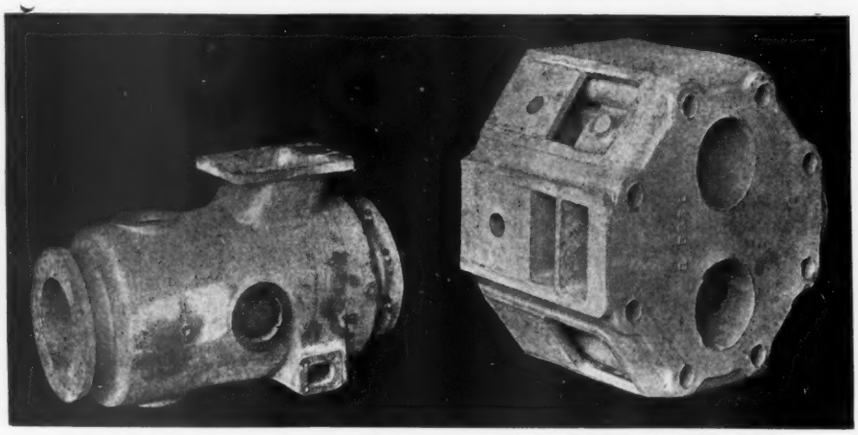


FIG. 3.—INTRICACY OF THE WORK IS SHOWN BY THE CYLINDER, TO THE LEFT, AND THE CYLINDER HEAD, TO THE RIGHT

While it is true that the soundness and strength of the castings is the most essential factor to be considered, it is also true that the general appearance of an engine, the smoothness of the skin and symmetry of form exert a certain amount of influence on the mind of a prospective customer and it therefore follows that the molds in which the castings are made require just as much attention and skill as the selection of the iron and the method by which it is mixed and melted. For the sake of clearness, the molding and core making methods pursued in this foundry will be described first and the metallurgical side of the question touched upon afterward.

In the first place, nearly all of the castings are poured in dry-sand molds. When it is remembered that practically half of the casting losses in foundries are directly tracable to wet or unevenly mixed sand it will be realized that while the initial cost of a dry-sand mold exceeds that of one made in green sand an ultimate saving is effected in the percentage of good castings secured. This is particularly true of the castings that have to withstand steam, gas or water pressure or of castings on which there is a considerable machine finishing. Many otherwise satisfactory castings have to be discarded when the machine operation discloses some hidden defects, or when a leak develops in the water-pressure test. The employment of dry-sand molds eliminates the formation of steam holes as well as preventing, to a great extent, segregation and shrinkage in the interior of the casting. A dry-sand mold also imparts to the outside of the casting a much better appearing skin than it is possible to secure by the green-sand method.

A mold that has been properly dried

will not drop, blow, scab or wash in front of the iron; it will also withstand the static pressure and weight of the iron and produce a casting truer to shape and weight than one made in green sand. This does not mean that satisfactory castings cannot be made in green-sand molds, for thousands of such castings are made every day. It simply means that a certain amount of risk attaches to the making of every green-sand mold while the dry-sand mold is practically sure to deliver a perfect casting.

Designed to facilitate the drying of the molds, the drags of all the flasks in this foundry are provided with bars, and bottom plates are dispensed with. The last part of a mold to dry under ordinary circumstances, is the bottom, owing to the fact that it is protected from the heat. A considerable amount of the steam generated in higher parts of the mold is condensed on its passage downward and increases the amount of moisture in the sand forming the bottom. Every foundryman who has had experience in drying molds or large cores knows how difficult it is to dry the bottom which rests on a plate, without burning the top. In the case of large cores it sometimes is necessary to roll the core over and remove the plate before the sand can be dried. All of these difficulties have been overcome in this shop by providing bars in the drags, a feature which obviates the necessity of using bottom plates. When the molds are placed in the oven to dry the heat has equal access to the bottom and top, and the result is that they are dried more evenly and in much less time than if a bottom plate was attached.

The flasks for the bed plates, one of which is shown in Fig. 6 and another in Fig. 9, are designed to hold a minimum quantity of sand. Several sizes of these castings are made and while they all possess the same general characteristics the details of molding vary to a certain extent between the small sizes and the larger ones. They are all molded flange up, that is, in the reverse position from the one they will assume when assembled and in operation. In the larger sizes a cope is employed. A cast-iron arbor serves to carry the sand on the inside of the pattern. This arbor is attached to the cope and both are lifted together.

In the smaller sizes no cope is employed. The lightening cores around the side are supported on stud chaplets resting on the bottom face of the mold. The main cores in the center cut through and rest on the bottom also. The points where they join the sand in the drag form the

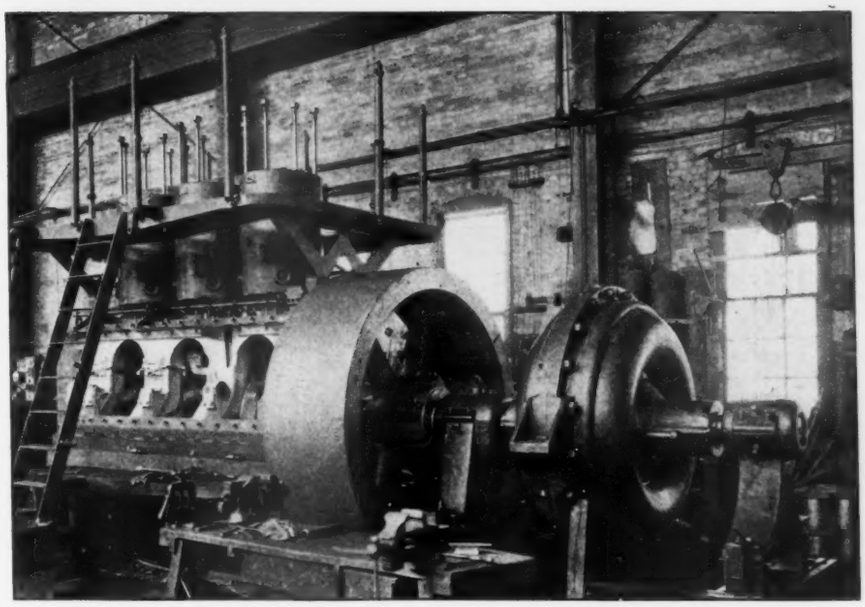


FIG. 4.—PARTLY ASSEMBLED 300-HORSEPOWER GAS ENGINE—AFTER ASSEMBLY IS COMPLETED THE ENGINE IS TESTED UNDER LOAD BEFORE BEING SENT TO THE CUSTOMER

openings for the driving rods of the engine. After the drag has been finished, dried and cored, four slab cores are lowered on the drag in lieu of a cope. These cores may be held down by a row of binders or, in some cases, a cope is set on. In the latter case the binders are wedged beneath the bars of the cope which is rammed full of sand.

The larger engine beds, those ranging in size from 300 to 1000 horsepower are poured at both ends; but the smaller sizes are poured only at one end. Two runners are employed, the metal entering the mold through narrow gates near the bottom. Some of the beds are designed with a deep bead or groove around the face of the casting that is molded down. The groove in the casting means a projecting body of sand in the mold. It is customary to ram a piece of dry-sand core at the two points where the stream of metal from the gates first enters the mold. The groove formed of the same dry-sand facing as the remainder of the mold and reinforced with a few nails would be considered amply secure by the majority of foundrymen. The piece of dry-sand core makes it absolutely secure and is cited at this point merely to illustrate the general policy of the management to make everything as near perfect as possible.

The mold shown in the illustration, Fig. 9 is for a 300-horsepower gas-engine bed. After the mold has been assembled, it is placed in a pit for convenience in pouring. The cope and drag are held together by a number

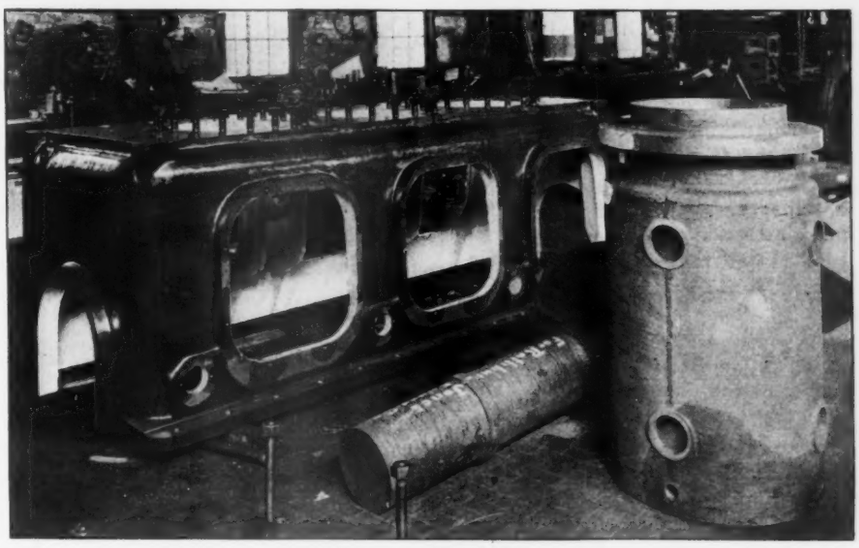


FIG. 5.—BED PLATES MUST BE STRONG, AND CLOSE-GRAINED IRON IS REQUIRED—A GREAT MANY THREADED HOLES ARE TAPPED IN THE CASTING—TO THE RIGHT A CYLINDER CASTING IS SHOWN

of bolts at the joint flange. The stacks of iron flasks shown resting on the cope are to prevent the cope bars from springing in the center.

Fly wheels, blank gears and other work of a similar character are made in the type of flask shown in Fig. 8. The cope is cast in one piece with the exception of an opening in the center. Separate bars are wedged or bolted in this opening to accommodate any size or shape of hub. The method of pouring the wheels differs in this shop from the generally accepted practice. Instead of pouring them through the hub with one or two runners, they are poured between two of the arms about midway between the hub and the rim. A single upright runner is used and a branch connecting the two arms is cut at the joint. It is claimed that this method of gating gives a cleaner casting than where they are poured directly on the hub. Feeding risers are placed on the hub and rim as usual and the castings are fed after they are poured.

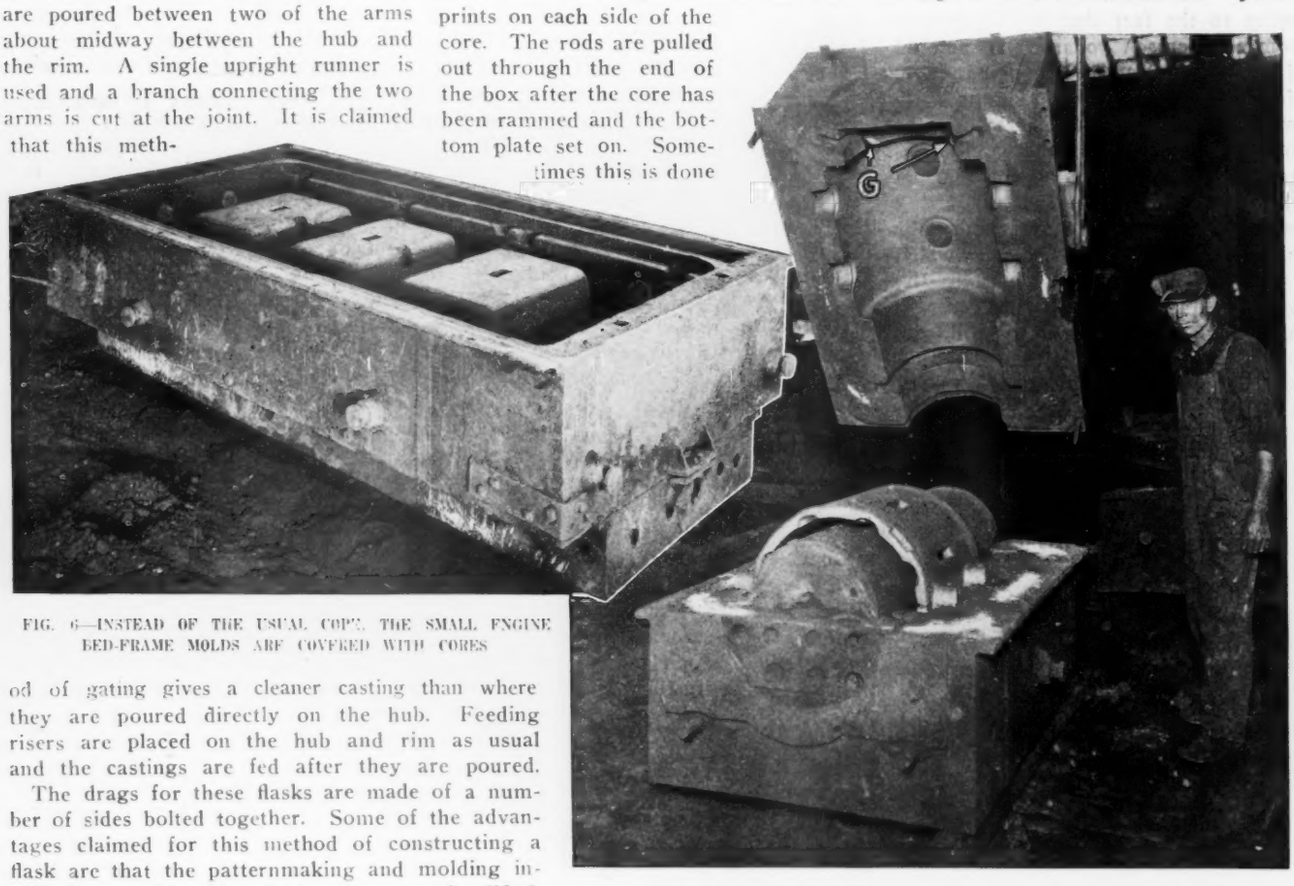


FIG. 6—INSTEAD OF THE USUAL COPE, THE SMALL ENGINE BED-FRAME MOLDS ARE COVERED WITH CORES

The drags for these flasks are made of a number of sides bolted together. Some of the advantages claimed for this method of constructing a flask are that the patternmaking and molding involved in making the flask parts are simplified. The ordinary foundry carpenter is quite qualified to make a section of a pattern that can be molded and cast on its flat in open sand as is done in making the sides for flasks. Another point in favor of the built-up flask is that, if necessary, thickness pieces can be placed between the joints of the different sections thus making the flask considerably larger.

The cores are divided into two general classes: stock cores, thin delicate cores and jacket cores are made from sharp sand bonded with an oil binder in varying proportions; and all other cores which are made from a mixture of old and new sharp sand are bonded with glutrin. The sand employed is of an open and free venting character and in a great many instances no artificial aid is necessary to carry off the gases. Some of the cores, however, are almost completely surrounded by iron when in use and it is necessary to provide channels in the interior of the core to facilitate the escape of the gas through one or more core prints. This feature is taken care of by placing a number of wires or small rods in the corebox before it is filled with sand. After the core has been rammed these wires or rods are withdrawn. In the case of the jacket cores transverse channels are scooped in the sand and filled with fine coke. The coke vents embrace all the rods the entire way across and converge toward the two prints on each side of the core. The rods are pulled out through the end of the box after the core has been rammed and the bottom plate set on. Sometimes this is done before, but generally after the core and corebox have been rolled over. After the corebox has been lifted off, the holes in the end of the core are stopped by the finger and slicked over.

All of the cores receive at least one coating of blackwash and some of them are coated several times. The blacking employed is not of the usual character of that used on cores but is the kind which is generally put on molds and known to the trade as *silver lead*. When the castings leave the sand the skin is perfectly clean, both inside and out. No castings are lost on account of dirt gathered in the mold and held in suspension by the iron. A typical mold for one of the gas engine cylinder is shown in Fig. 7. It will be noted that the cope and drag halves of the flask are alike and no bottom board is used. These flasks are made with semi-circular openings in the ends, but when in use one end is stopped with an iron plate provided with a number of holes as shown. The flasks are elevated about a foot at one end before the mold is poured. A runner is situated on each side, close to the core print at the low end of the mold. The gates are cut into the core print as shown at *G*, Fig. 7. One large riser is taken off the flange in the high end of the mold. The cylinders are poured from a semisteel mixture and the large riser is used for a feeder after the casting is poured.

FIG. 7—NO BOTTOM PLATES ARE ATTACHED TO THE CYLINDER FLASKS—COPES AND DRAGS ARE ALIKE

Chaplets are dispensed with in making these castings. The main or center core rests on a print at each end of the mold. One end butts against the end of the core print but the other end extends through the open end of the flask. A certain amount of the vent escapes through the closed end of the mold but the greater amount finds its way out through the unobstructed end.

The jacket core is heavily reinforced with a double set of rods running at right angles to each other. It is held in place by two branch cores on either

side at the joint line of the mold and is supported top and bottom by two short pieces of round core attached respectively to the face of the mold in the cope and drag. These short pieces of core are dropped into place while the mold is green. A little paste is placed in the print, then the core is introduced after which the sand is tucked firmly around it and slicked to conform to its original shape. All the vent from the jacket core is taken off through the four prints at the joint line.

Melting the Iron

The iron is melted in a cupola lined to 41 inches. The bed charge of coke consists of 1200 pounds while the succeeding charges of iron and coke weigh 1600 and 300 pounds respectively. The charges of iron are made up in varying proportions to suit the different classes of work handled in the shop. Iron for ordinary work like bed plates, frames, fly wheels and work of a similar character which does not have to withstand a pressure test, is poured from a mixture approximating 1000 pounds of pig iron and 600 pounds of scrap. The scrap used is at all times of a superior character.

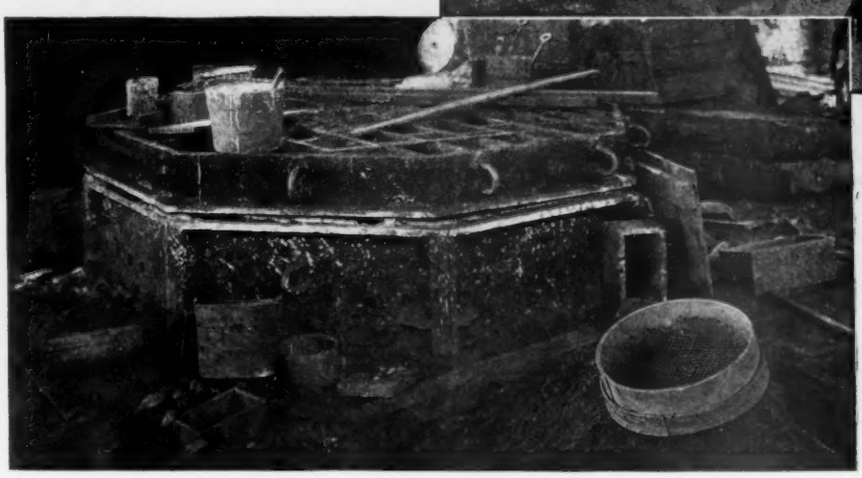


FIG. 8.—MANY BUILT-UP OCTAGONAL FLASKS ARE EMPLOYED—ONE OF THE ADVANTAGES CLAIMED FOR THIS TYPE FLASK IS THAT ITS CAPACITY MAY BE INCREASED BY INSERTING THICKNESS PIECES BETWEEN THE JOINTS

Burned scrap or thin oxidized iron is never handled under any consideration.

Little outside scrap is bought and that only machinery scrap of the highest grade. The pig iron is bought by analysis but it is also judged by fracture. Excessive scoria on the top face or blow holes situated under the skin is deemed sufficient cause for rejecting a shipment. Several brands of pig iron are always kept in stock including one pile of charcoal iron. The latter is employed to promote density in castings subjected to a pressure test, and also to prevent segregation in castings containing sections of uneven thickness; and in general for any work of a special character.

The steel scrap employed in making semisteel consists principally of short pieces of rails and fish plates. The different varieties of pig iron and scrap are kept in individual piles, plainly marked and numbered. The charging card is made up in the office and the cupola man has no difficulty in following instructions.

FIG. 9.—MOLDS FOR THE LARGER ENGINE BEDS ARE ASSEMBLED AND POURED IN A PIT

Old Core Sand May Be Used Over Again

Question: We understand that it is customary in some foundries to use the burned core sand which has been removed from the castings. We should appreciate any information on this point and also if it is necessary to employ any special binder.

Answer: We do not kow of any foundries that make all their cores exclusively of burned sand The usual practice is to mix it with new sand in varying proportions, depending on the bulk of the core and the character of the work. The usual proportion for ordinary jobbing work is 50 per cent. To put it another way the foundryman plans to use all the old sand possible and adds just enough new sand to make up the amount required each day.

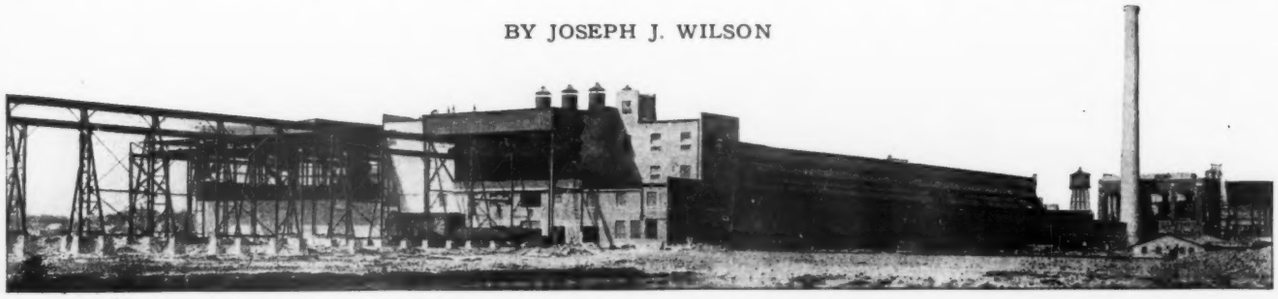
Without special equipment it is not economical to attempt to use much old sand A considerable quantity of the core sand removed from castings is actually burned and therefore of no more use and a great deal more is in the shape of hard lump. To attempt to screen the former or break the latter up by hand would more than offset any gain to be derived from the saving in the cost of new sand. In such cases it is customary to gather up as much of the sand as runs freely and use it in the core mixture.

However, there are core sand reclaiming devices on the market now which make it possible to reclaim practically all the sand from the castings. In many cases only a small part of a core's surface comes in contact with the molten metal. The core cannot be used again as a core but it would certainly pay to reclaim the sand which is good. In such cases, also, the amount of binder can be reduced since the unburned cores already carry a considerable quantity of binder which did not volatilize.

The E. R. Smead Co., Philadelphia, has been appointed district representative for the Werner G. Smith Co., Cleveland. Warehouse stock of the Werner G. Smith Co.'s core oils will be carried. Distribution will be under the general direction of L. P. Robinson, New England manager.

Choosing Correct Plant Equipment

BY JOSEPH J. WILSON



THE foundry industry may be divided into jobbing and production foundries. The majority of foundries are engaged in making heavy and light jobbing castings, which may vary from a lathe bed to a casting of a few pounds. Their production from a given pattern would, on the average, not exceed 30 castings per year.

The buildings and equipment of these foundries must be general in scope and adaptable to a wide range of usefulness. The buildings must be well lighted and heated, and easily ventilated. The material yard should be so laid out as to reduce the handling of material to a minimum, and if possible be served by a traveling crane. The layout of the foundry, core room and cleaning room, must be flexible to permit the handling of a great variety of jobs without making changes. For the heavier class of work the overhead traveling crane as well as the wall jib crane, with either electric or air hoists, has become indispensable in the foundry. The molding machines must necessarily be confined to the most general types on which no expensive mounting of patterns is necessary, such as plain jolts and plain hand or power-jolt squeezers of the standard types.

The core room should have electric air hoists for rolling heavy core boxes and handling large cores. A plain jolt machine of the proper size would be an aid in almost any jobbing core room.

Efficient Cleaning Room

The cleaning room of a modern jobbing foundry should have a sand blast equipment for cleaning the castings; air hammers for chipping; cranes and hoists for handling the heavier castings; and tumbling mills and grinders for the smaller work.

The production foundry can be subdivided into three classes: The specialty foundry, which confines itself to one, or a very small variety of castings, and is therefore in a position to build its equipment around a single product, making the molding and cleaning operations as well as the sand handling almost automatic. Extreme types of this class are the Kewanee Boiler Co., Kewanee, Ill. Kelsey Wheel Co., Detroit, French & Hecht, Davenport, Ia., James B. Clow & Sons, Chicago, and Crane Co., Chicago.

The next class is the jobbing production shop, which is wholly dependent on outside work and will only accept orders insuring a steady production for a given period. The pattern equipment may consist of gated patterns, match plates, stripping plates, or split pattern plates, rigged and furnished according to the specifications of the foundry. The demands of the foundry are governed somewhat by the available machine equipment. In order to get the benefit of the latest developments in molding and core machines some manufactureers have adopted the policy of buying the machines, mounting the patterns, building the flasks, and then turning the whole equipment over to a foundry. This relieves the foundry of a great initial expense and is in most cases quite desirable.

The third class is the so-called Corporation foundry, which is connected with a manufacturing institution that turns out a standard product, the size and weight of which will remain within close limits from one season to another, such as agricultural implements, radiators, valves and fittings, and automobiles.

The foundry industry owes its rapid development in the equipment line of the last few years to these foundries. They have encouraged and adopted new developments in building and equipment construction on a scale, which from a financial standpoint alone, would be out of question in an independent jobbing shop.

While the developments of the past few years have given us the multiple-story foundry, such as those operated by the Buick Motor Co., Flint, Mich., Deere & Co., Moline, Ill., French & Hecht and Crane & Co., and the semi-automatic foundry where elaborate conveyors form a predominant part of the permanent equipment and building construction, such as the foundries of Dodge Bros., Detroit, Ford Motor Co., Detroit, Samson Tractor Co., Janesville, Wis., and the new plant of the Aluminum Manufacturers, Inc., Cleveland. We still have the modern foundry in which conveyors are practically eliminated, and where the molds are shaken out and the sand tempered on the floor. All these types must be accepted as modern. My personal choice is the one-story foundry with limited or no permanent conveyor equipment, on account of its great flexibility and the absence of vibration.

What is true of the buildings of a foundry is also true of its machine equipment. A machine may be up-to-date for one job and wholly out-of-date for another. For example—a plain jolt may comprise the latest thing for a modern jobbing shop, but would be out-of-date and indicate antiquated methods if applied to a cylinder block for an automobile motor. While some of our modern equip-

WHEN a company spends vast sums of money on a plant for producing castings much thought naturally is given to the design and functions of equipment entering into the finished machine. Therefore reasons for the selection of machines and appliances for the foundry of the Saginaw Products Co., division of the General Motors Co., Saginaw, Mich., as given by Joseph J. Wilson, plants manager, in a paper presented at the New York meeting of the National Founders association, is of great interest to foundrymen. An illustrated description of this plant was presented in THE FOUNDRY, *Oct. 1, 1919, and Mr. Wilson's analysis of the various motives governing selections of equipment rounds out the complete story of this most complete institution.*

ment is designed for the purpose of improving the quality of the product manufactured, we find that the necessity of saving labor outweighs all other considerations.

The handling of material plays a big role in the foundry, and should therefore receive considerable attention in designing and equipping a plant. At the foundry of the Buick Company we found, for every ton of castings produced we had to handle 64 tons of material and in spite of the fact that the layout of the plant made a continuous flow of material possible.

Labor Saving in the Yard

A great amount of labor can be saved in the properly arranged yard, equipped with an overhead traveling crane with electric magnet and grab bucket. One operator and one laborer can unload a car of pig iron with a magnet in the average time of 45 minutes. This estimate takes into consideration every type of car and transferring the metal an average distance of 50 feet. To do the same job without a magnet, even on a piece work basis, would require at least 15 men. If the yard is laid out so a car can be spotted opposite the pile, 25 minutes is a good average time. If space permits, the yard should be laid out so the same crane can also supply the cupola charging platform with iron, limestone and coke. The coke may be stored in the yard and handled with a grab bucket, or, to avoid the crushing of coke, a storage room holding from 20 to 30 cars, according to the size of the plant, may be provided adjacent to the charging platform and on the same level. A hopper may be built at the level of the track to receive the coke, which may be hoisted from here to the storage room by means of a bucket elevator. A monorail system in connection with an elevator also gives excellent service.

The modern equipments for handling the molding and core sand differ considerably from each other depending largely on local conditions. Where the foundry is located on high ground, a basement can be provided and the sand unloaded by gravity directly into bins. In a multiple-story foundry where the sand can be stored on the first or ground floor, a belt conveyor running from hoppers located near the railroad tracks is a good means to distribute the sand into the different bins. A unique and novel installation can be found at the Central foundry of the General Motors Co. It consists of a series of concrete bins, open at the top and under one roof which extends over the car tracks. The bins are located at the end of the core room and adjacent to the facing sand room. Overhead bridge cranes equipped with grab buckets, unload the cars. These same buckets also take the sand from the bins and feed it into hoppers which are about six feet above the floor and are equipped with clamshell gates. By having these hoppers located directly over the sand mixers, the mixers can be loaded by simply opening the clam shells. To accommodate all types of cars a shallow pit is provided under the track, extending far enough on each side to permit the grab bucket to be dropped between the track and the pit wall. With this arrangement one crane operator and two laborers, who guide the bucket into the car or pit as the case may be, and who also trim the corners of the car, can unload an open car of sand in the average time of 45 minutes. During the summer months when core sand comes in daily, the sand is unloaded directly into the hoppers leading to the core room. Since the outlets of these hoppers are directly over the sand mixers about 40 per cent of the core is handled only once before it is mixed and ready for the core maker.

Foundry melting equipment has not undergone any radical changes lately. The recent developments are practically all confined to the electric furnace. Some cupolas are provided with charging machines which tip the charge from the truck into the cupola; another charging system consists of a bottom-dump monorail car, in which the charges are placed and which run into the furnace where the charge is dumped. While some of these mechanical charging devices are being successfully operated by foundries making fairly heavy work, the foundries making light castings which require uniformly hot iron are slow to replace hand charging.

Two Charging Floors

The handling and rehandling of the sprues and scrap in the foundry and on the charging floor is quite a large item. To reduce this handling labor a second charging floor is sometimes constructed above the regular charging floor. The sprues are collected through the foundry in steel dump buggies which hold just about enough for one charge. The buggies are collected through the shop by a tractor and taken to the elevator leading to the charging platform. Here the loads are weighed and the charges corrected. The charge is now run up to the upper platform and tipped into the cupola, the distance between the two doors being sufficient to spread the scrap evenly across the charge.

The modern type equipment used for distributing and pouring iron must satisfy a great number of varied conditions. It may consist of hand-pushed or electrically driven ladle buggies running on a track or on the bare floor; it may be a heavy overhead traveling crane, a pouring bridge, a ladle suspended from a trolley and moving along a monorail, or an electrically operated monorail crane. The monorail car with electric drive and hoist is perhaps one of the latest developments. This equipment gives excellent service in continuously operating foundries, especially where long hauls are necessary. These cars travel at a speed of 480 feet per minute, and in order to run the cars at the maximum speed, switches should be eliminated as far as possible. Where a double-track system in front of the cupola is necessary it is more satisfactory to use a ball-bearing extension spout to reach the car on the outside track than to run on the inside track by means of a switch. This spout should be constructed so it can be swung out of the way by the tapper when a car on the inside is to be loaded.

Molds Carried to the Iron

Pouring devices of the brillion type work well if used in conjunction with the electric car. Conveyor systems which carry the molds to the iron have also received considerable attention of late, but since these installations also require in connection, a return system for the sand, they must remain a part of the specialty foundry.

The mixing of core sand and facing, handling and conditioning the molding sand, are items of great importance in the modern foundry. Therefore, they have received considerable attention during the last few years. For mixing the bulk of core sand my preference is the combination of a riddle and paddle mixer, while for an oil sand mixture, such as is used in a cylinder jacket core, the crusher type gives excellent service.

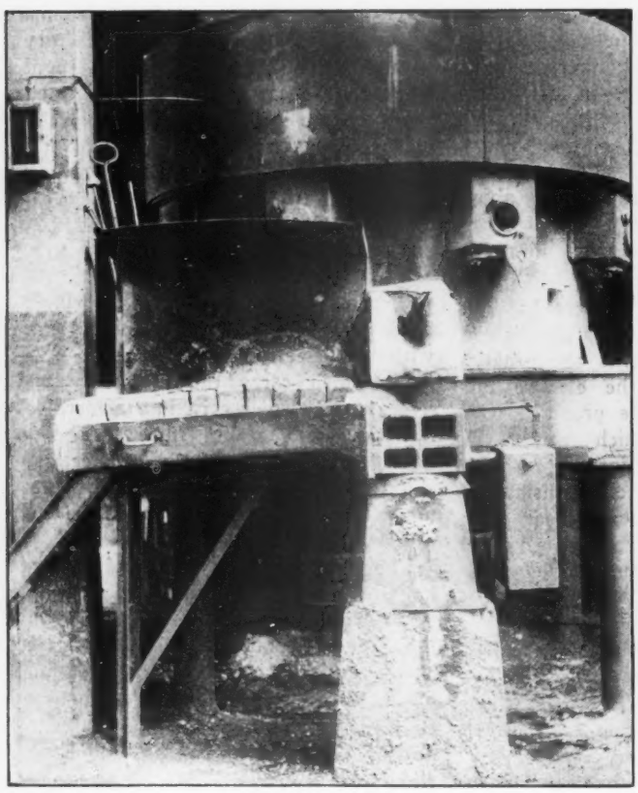
A modern installation for mixing facing may vary from a plain power riddle to a combination of a riddle, a crusher, and a centrifugal machine. A combination of the last type is in operation at the Central foundry and is giving splendid results. The batch is made up in front of the riddle located on the floor level and shoveled into it by hand; a short bucket elevator raises the sand from the riddle to the crushing mill where the mixture is thoroughly ground. Another short elevator raises the facing to the top of the centrifugal mixer which discharges the facing directly into the bins below. The capacity of one of

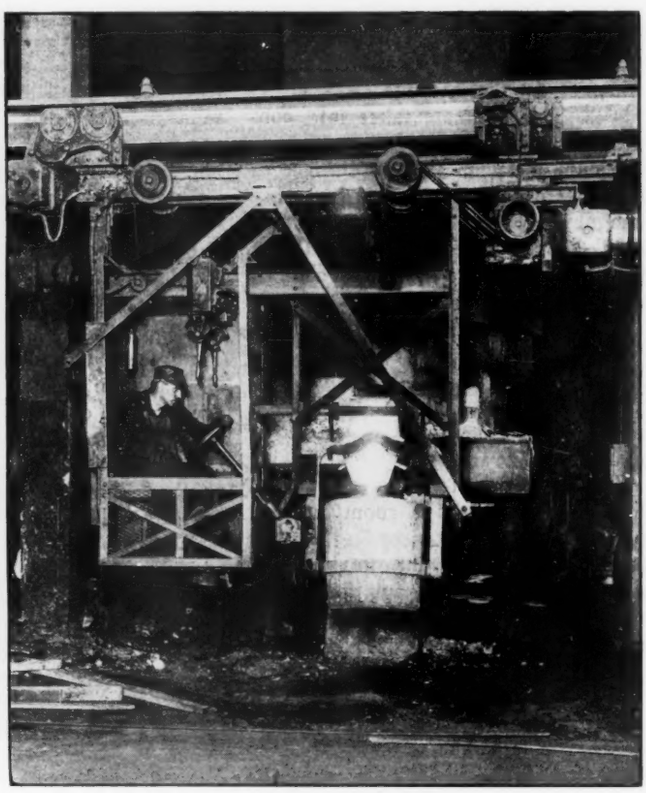
these units is 158 tons per 9 hours of continuous operation. A crew of three men, making up the batches and running the machinery intermittently can mix about 46 tons of facing per 9 hours.

Perfecting mechanical means for replacing human labor in handling and conditioning molding sand has held the attention of the foundry engineer for some years and has resulted in a number of elaborate installations. It forms the basis for the multi-story, automatic and semi-automatic foundry. While the purpose of these installations is to save labor and get maximum production per square foot of floor space by making the operations continuous, the real purpose is a lower manufacturing cost, resulting in a greater return on the money invested in the project. While excessive claims have been made by some of the designers of these installations we are still waiting for earning of large profits as a result of these various layouts. It is true that these installations will show low costs on some individual operations, but after the maintenance and overhead charges are added the showing will usually take a different aspect.

The operations affected by the ordinary system would be molding, pouring and shaking out. If the molds are poured on the floor they are usually shaken out over a grate beneath which a continuous belt conveyor receives the sand and carries it to a tempering station from where it is delivered back to the floor ready for molding. A belt or a push-plate conveyor is usually employed for delivering the sand to the molder. This is especially true of the smaller class of work. Where the molds are taken away from the floor as fast as they are made and are poured at a central station, the shaking out is done at a certain point in the line, usually near the mixers. At the foundry of the Buick company monorail cars are taking the place of conveyors. The molds are poured on the floor and the sand is dumped through a grate to the floor below where it is tempered by a man with a water hose. The sand is then picked up by a grab bucket suspended from an electric monorail car and moved to a hopper which feeds a rotary riddle that in turn empties into the bottom of a bucket elevator. The elevator raises the sand to a reservoir on the roof from where it is distributed over the foundry by means of an electric monorail car, equipped with a drop-bottom box. Each floor has either one or two cylindrical containers, open at the top and bottom, that receive the sand from the cars and from which the sand is shoveled into the flask.

In designing the Central foundry the various conveyor systems were investigated and it was finally decided to put all operations on the ground floor and to put in no fixed sand-handling equipment. The foundry is laid out in four bays, running the full length of the shop, with a gangway for transporting cores and castings along each outside wall, and a gangway of double width between the two center bays. A double monorail track between each two bays is used for distributing the iron. This arrangement keeps the iron out of the material gangway and avoids a lot of accidents. It also gives us flexibility to such an extent that we can turn a cylinder floor to the work of molding valves almost over night, the molding machines being the only equipment to be moved.





AN EXTENSION SPOUT SWINGS ON A PIVOT AND IS USED TO FILL LADLES ON THE SECOND TRACK FROM THE CUPOLA—A MONORAIL TROLLEY WITH AN OPERATOR'S CAGE CARRIES THE METAL TO THE MOLDING FLOORS

In order to save floor space and flask equipment the foundry is run continuously; that is, the pouring starts at seven o'clock in the morning and the bottom is dropped at 4:30 p. m. After giving the matter considerable thought it was decided to set the molding machines in the center of the floor, instead of at the end, as is customary. The molders start on the east side of the machines, and after placing about 24 molds (the number varying according to the size of the job) they move to the west side. Then while they fill up this space the molds on the east side are poured and shaken out, and

the sand is tempered and cut back to the machine with a sandcutter. By this method 120 to 140 molds, 24 x 36, of a four-cylinder block with crankcase attached, can be molded on a floor 24 x 60 feet. This same floor space will also produce 100 to 110 six-cylinder blocks, each of these floors requiring 40 flasks. For jobs like crankcases requiring little core setting and which are quick cooling, a production of 200 to 225 molds, requires a floor space of 960 square feet. We have also produced six hundred and thirty 12 x 18 snap molds on a floor space of 480 square feet.

Machine Cuts Sand

With this method the molds are shaken out on the floor so the sand will form two rough heaps, which are wet down and then cut back to the machine by a sandcutter. A machine operator and one laborer, who trims the heap and clears the wheels of the sand cutter, are able to handle about 9300 cubic feet of sand per 9 hours, or all the sand required for 900 to 1000 six-cylinder molds. For handling flasks, molds and castings, each floor has one or two single I-beam, one-ton, hand-push cranes, each with one-ton air hoist.

In selecting molding and core machines the condition of the patterns and the quantity of castings required are the dominant factors. For example, if I receive an order to furnish daily 200 valve castings for a gasoline motor I would make either a gated brass pattern or an aluminum match plate, and use a plain hand or power squeezer of any standard make. However if the order called for a production of 20,000 castings per day I would build an iron split-pattern-plate equipment and mount them on the two fastest jolt-squeeze, pattern-draw machines on the market, then produce them with two laborers. If I had 30 flywheels to make I would probably make them on a plain jolt or hand rollover machine, but if the order called for a daily production of 250 to 350 castings, I would make them on two jolt-squeeze, stripping machines.

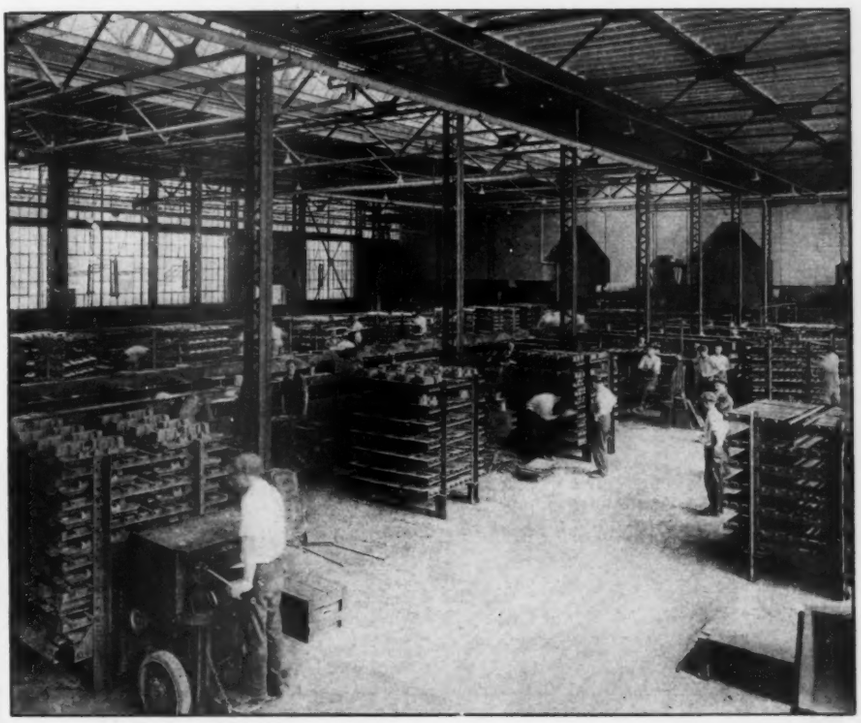
The combination jolt-squeeze, pattern-draw machine has the greatest speed and requires the least skill on the part of the operator. For heavy drags the jolt-rollover machine is the most economical as only the finished drag needs to be set on the floor. Since by this method no bars are required in the drag flask, the shaking out is considerably more simple.

While there are some jobs in the core room which adapt themselves to combination power machines, the plain hand rollover, pattern-draw type has to be accepted as standard. There are great possibilities for the core-blowing machines, but this type must naturally be confined to the production and specialty shop.

In equipping a plant with molding and core machines the proposition should be viewed from every angle and the selection be confined to as few models as possible. Great advantage would accrue if it were possible to do all the molding on one model. A complete stock of repair parts could be carried to an extent that would be prohibitive were many different makes in use. All patterns, plates and mountings could be made and drilled interchangeable, so any one machine would take the pattern equipment of any other machine. It would allow the changing of men from one floor to another without lowering their efficiency, which cannot be avoided if the machines are of different makes.

When we started the Central foundry there was a great scarcity of men and we decided to equip our core room so 75 per cent of the operations could be done by girls. We selected a rollover-draw machine of a balanced type which enables a girl to handle boxes that weigh over 50 pounds when empty. When mounted on the machine, filled with sand and coreplate clamped on, the outfit weights about 75 pounds. The heaviest part of the operation is the handling of the core after it is made, the core and plate weighing about 30 pounds. The rolling of the machine, clamping and drawing requires little effort. We were not only able to obtain the necessary labor by this arrangement, but we also increased our production from a given core box from 25 to 75 per cent, and our core-making cost was reduced as much as 50 per cent under former practice on jobs which paid the girls $5.50 to $6.00 per day.

A light air hoist may be a great aid to production, for example, on one certain core requiring a heavy iron box with all four sides loose, 90 to 100 cores was considered a day's work. Being unable to find a machine on the market that would handle this job we installed a half-ton hoist between each two core boxes, and put trunions on the boxes, also angle-iron guides to facilitate the drawing of the slides. Then a laborer on each core box and one helper between each two coremakers to operate the hoist and carry the cores away, produced from 120 to 140 cores from each box at about half the former cost.



THE CORE ROOM IS WELL LIGHTED—THE CORES ARE TRANSFERRED ON RACKS BY ELECTRIC LIFT TRUCKS

Core Room Equipment

On the assembling operations gravity conveyors are used for cores which are beyond the weight allowed for girls. In order to furnish the foundry with uniformly accurate cores without resorting to skilled mechanics, the joints of the split cores, as well as the barrel openings of the jacket cores, are ground to size on

especially designed fitting machines.

When modern foundry equipment is discussed one important item is usually overlooked, namely, the flask equipment. Many pattern and machine equipments have been condemned because the flasks did not receive the required attention when the equipment was selected. While the material of which the flask is made is less important than the design it will always be found on careful analysis that one certain material is better than another for the particular job on hand. We only can get the maximum service from a modern machine equipment when the design and construction of the flask is equally as modern. By studying the peculiarities of machine-rammed molds and then designing our flasks accordingly we have been able to completely eliminate all gaggers from our production work. To show you how far this can be carried I will give you an actual example. We received a job, patterns, flasks and machines, which had been running at an outside foundry for about two years, and is generally known as a bad job. The flasks were good cast-iron flasks with machined joints and the customary number of bars. It required 78 gaggers and 42 twentypenny spikes for each mold. Since the type of labor we were forced to employ would not stay on the job long enough to learn to set these gaggers we designed a new flask which resulted in the complete elimination of all gaggers and allowed a reduction of the number of spikes and nails to eight, for both cope and drag. We were also able to discontinue tucking the bars. In this way a laborer who can operate the machine and shovel sand, can give us a perfect mold. What was considered a bad proposition has become a good job, with a loss of under 10 per cent, instead of the previous loss amounting to 40 to 60 per cent. This is also the only job on which we are using nails, although our work is all of more or less intricate and irregular shape and our sand has to be kept fairly weak in order to run our thin-section work.

There is a great variety of equipment for handling material around a plant, such as cores, sand, castings and refuse. The conveyances may consist of a wheelbarrow; a two or four-wheel hand truck; a monorail car, with or without electric drive; a gravity or mechanical conveyor; or an electric or gasoline tractor. Where space permits and where the size of the plant warrants it the electric lift truck and the electric and the gasoline tractor are the most flexible. If this method is adopted a sufficient number of trucks and racks should be secured so the tractor or lift truck can take a full load every round trip, collecting loaded trucks and returning empty ones to the floors.

SAND IS UNLOADED INTO BINS WITH TRAVELING CRANES EQUIPPED WITH GRAB BUCKETS

Ordinarily all cleaning operations are placed under one roof and in one room, which is known as the cleaning room. Even under good management the old time cleaning room has been a dusty and somewhat disagreeable place because the dust and smoke resulting from knocking out cores, and similar operations, contaminated the whole department. To avoid this condition at the Central foundry we segrated the knocking out and sand-blasting from the rest of the cleaning operations. These operations are located in a building between the foundry and the cleaning room, with the result that the cleaning room is as free from dust and dirt as our pattern shop. The refuse sand from this knock-out department drops through gratings onto a belt conveyor underneath the floor. The belt raises the sand on an incline to a magnetic separator. By passing all foundry and cleaning room sweepings over this separator little iron is lost.

The sand-blast and exhaust systems have received the most attention of the cleaning room equipment and have undergone considerable improvement in the last few years. Lift trucks, tractors, gravity conveyors, chipping stands that permit the chipper to turn his work and hold his job at any angle without setting down his air hammer, are great aids in reducing the cleaning cost. Where water-testing has to be done to any great extent, mechanical testing machines should replace the old expansion plug method. With one of these home-made air-operated machines it is possible to test 60 cylinder blocks per hour. At this speed the casting is only under 90 to 100 pounds pressure for a period of 15 to 20 seconds, but we have found this adequate on all our cylinders, cylinder heads and manifolds.

While we are always interested in new equipment used directly in the manufacturing of castings we are quite apt to overlook the importance of modern sanitary equipment. The first aid department and modern toilet facilities, with wash rooms, shower baths, and locker rooms which give the men who take some pride in their appearance a chance to clean up after a day's work, have become a necessary part of the modern foundry and are a good investment.

Copper may be corroded black by dipped it into an acid consisting of copper nitrate, 600 grams; water, 300 grams, and silver nitrate, 2 grams. After dipping, the articles are heated. A solution of cupric carbonate, 10 grams; spirits of ammonia, 70 grams, and water, 150 grams, is sometimes used for the same purpose.

It is often desirable to retard the setting of plaster of paris, in making patterns, matches and coreboxes. All that is necessary is to add a few drops of glue to the water used for mixing the plaster. About a quarter teaspoonfull of liquid glue is the maximum amount to add to one gallon of plaster.

Analyze Loss in Aluminum Shops–I

Replies to Questionnaires on Casting Losses Are Analyzed and a Study Is Made of Causes For and Prevention of Defects in Castings—Enumeration of the Principal Typical Faults

BY ROBERT J. ANDERSON

WHEN consideration is given to the general subject of scrap losses and metal wastes in the industries two main problems are presented; namely, the study of the causes for and methods of reducing the percentage of defective or waster material, and the economical disposal of scrap. A certain minimum amount of scrap and defective material arises in the casting, rolling, and fabrication of metals and their alloys for industrial purposes. However, the indications are that in nearly every branch of the metal industry scrap losses are at times high, and in some plants they are entirely too high.

Few, if any, published figures are available for losses in the production of castings, although foundrymen are well aware of the fact that waster castings are made every day. The scrap pile is the barometer by which the efficiency of a plant in the metal industry can be judged, and the relation of defective material to total output may be the determining factor in deciding whether any plant operates at a profit or not. It must be admitted that there is no accurate information available regarding the monetary losses *thus sustained by the industries of the country in the production of defective material.

Although no actual figures are available for the entire foundry industry, the savings which would accrue by avoiding all preventable losses would amount to several million dollars in a year. In the aluminum-foundry industry alone, it is estimated that about $600,000 per year could be saved if the present casting losses were cut in half.

It is hoped this series will be useful to foundrymen in studying methods of reducing casting losses in the production of aluminum-alloy castings in individual plants. The investigation was carried out by the bureau of mines in connection with its studies of metalliferous wastes in the United States. Practical experience together with observation of the practice at many foundries and the results of inquiries and communications to the bureau have indicated that casting losses in aluminum-foundry practice are generally much higher than is experienced in iron, steel, or brass and bronze founding.

In differentiating between so-called commercial alluminum-alloy castings and special castings, the former are usually produced according to no specifications and under lax inspection, whereas special castings must ordinarily meet rigid physical and chemical requirements and pass the severest kind of inspection. Losses in the production of aluminum-alloy castings to specifications, as a general rule, may be expected to be higher than where no specifications are in force. In the instance of complicated castings, for example, the crankcase and oil pan for the 12-cylinder Liberty motor, and crankcases and oil pans for some of the standard American motor cars, casting losses due to rejections have been unusually high.

Casting Losses High

The war had a rather salutary effect upon aluminum alloy casting practice for the reason that the foundries were called upon to meet rigid specifications; moreover, the output had to be in large volume. Thus, the foundries were placed in the unenviable position of trying to turn out quality and quantity production at the same time. As regards sand castings in aluminum alloys for the Liberty, Hispano-Suiza, Curtiss, and other motors, neither the chemical nor physical specifications were at all difficult to meet, but the inspection and salvage specifications were fairly rigid, and some foundrymen regarded them as altogether too strict. The matter of specifications for inspection has never been settled, but losses in the production of aircraft-motor castings were high, in fact, altogether too high, when considered in relation to motor output. However, castings losses in the production of carburetors, camshaft housings, and intake headers for the Liberty motor were reasonably low.

Both before the war and at the present time, aluminum founders, particularly the small and medium-sized shops, have trouble with cracks, blows, pin holes, sand holes, porosity, draws, and other defects in aluminum-alloy castings. These faults occur in the production of castings whether in large or small foundries, but the small shops appear to have been unable to correct the difficulties even to their own satisfaction. In co-operation with THE FOUNDRY, questionnaires were sent to all aluminum foundries and reports of difficulties in the production of aluminum-alloy castings are continually being sent to the bureau, and numerous inquiries have been received. Reasonably exact figures for the casting losses in aluminum founding in the United States are now made available, and an average figure has been deduced from the results of the present investigation. Aluminum foundrymen are well aware of the fact the unaccounted for difficulties in production arise from time to time. Thus, a foundry may run for a considerable period, say three months, producing satisfactory castings with a reasonably low percentage of defectives. Suddenly, and for no particular reason which can be determined, the castings commence to run *bad*, and losses mount to high figures. Casting losses may be high for several days or weeks, when the losses will decrease and production again become normal, for no accountable reason. This situation is more or less peculiar to aluminum founding, but it also occurs in casting brass, bronze, and other nonferrous alloys, as well as iron and steel. The reason the problem is so particularly baffling in aluminum founding is that little scientific research has been applied to aluminum and its light alloys, and the literature is scant and considerably contradictory. Some foundrymen have been in the habit of blaming their difficulties on the metal, instead of paying attention to their foundry practice. There have been metal troubles in the past, and there is no reason to believe that there will not be more difficulties with metal in the future, but many of the casting losses today can be traced to readily avoidable causes in the foundry itself. There are a large number of factors over which the foundryman has direct control, but it is only by studying the defects occurring in castings that these can be traced to their causes. It appears that at least 75 per cent of the defects can be traced to the molding department and the remainder to metal-

Published by permission of the director, United States bureau of mines. The author, Mr. Anderson, is metallurgist, located at the bureau's experimental station Pittsburgh.

*Parsons, C. L., Notes on mineral wastes: Bull. 47, bureau of mines, 1912, p. 11.

lurgy, melting, and miscellany. Rejections vary considerably in different foundries depending upon the type of castings and local conditions. Moreover, as has been pointed out, specifications influence losses to a marked extent. If a motor-car builder operates a foundry for making his own motor castings, some that would be rejected on purchase from an outside foundry might be accepted. Furthermore, different castings are rejected for different reasons; porosity and leaks cannot be tolerated in crankcases, manifolds, and carburetors, but these same defects are not serious in clutch cones, rocker arms and in some kinds of housings and carriers. On the other hand, surface sand holes are sufficient cause for rejection in many kinds of castings which must be highly polished, such as vacuum-cleaner housings and parts, wheelhub caps, and instrument frames, but they may not be serious in most castings not requiring polishing.

The accuracy of scrap-loss data depends upon the detail with which the inspection records are made. Some foundries carry their inspection into greater detail than others, but in the majority of foundries detailed records are not kept. Thus, in some production records examined during the investigation the causes for every individual rejection were recorded while in others no figures were kept other than the total number of castings poured and the total number rejected. In order to determine to what length the inspection detail should be carried, it is necessary to consider the kind of castings made, their value, and the average loss. In considering casting losses in relation to foundry economics, it is necessary to bear in mind that the scrap-loss report constitutes one of the most important of the daily records. Defects in scrapped castings should be classified on daily record sheets. A systematic inspection of the production of castings in any foundry with a classification of the losses will permit the application of constructive preventative measures against the occurrence of the same defects in future production.

Scrap Records Valuable

In small foundries, and in foundries doing an extensively varied jobbing business, it is claimed that scrap-loss records cost more than they are worth. This view of the matter does not appear to be tenable, particularly in the instance of jobbing foundries, for jobbing foundries must know their costs accurately if they intend to remain in this highly competitive business. Scrap-loss records are particularly valuable in cost finding, as they indicate the folly of attempting to quote pound prices for castings, irrespective of the type of casting—a practice which still exists in many nonferrous foundries. The difficulties in tracing defects to their causes are by no means small if all factors are considered, since several different causes may result in the same defect. On the other hand, it is possible to formulate a reasonably systematic classification of causes for defective castings, and the proper records can be kept by the inspection department.

Separate records for individual castings are essential if losses are to be prorated to the separate jobs rather than lumped together, placed in the overhead, and distributed over the total output. By the latter system, some castings bear more than their just share of the losses, while others do not bear enough, and the result of distributing the losses rather than prorating them is to confuse the cost records. In fact, costs for separate classes of castings can never be known with accuracy unless the losses are prorated.

Diagnosis of Losses Helpful

While it is held that accurate scrap loss records should be kept by all foundries, and although it is believed that a careful inspection of defective castings and subsequent diagnosis of the losses will assist materially in reducing them, it cannot be held that it is possible to completely eliminate defective castings in aluminum foundries. It is possible to reduce losses as much as 50 per cent or more in many foundries but inherently some losses necessarily occur.

The object of the present investigation was to ascertain the casting losses in aluminum-foundry practice in the United States, and to suggest methods by which these losses may be reduced. Consequently, the effort was made to collect data from as many sources as possible, mainly from the aluminum foundries of the country. The problem of determining the casting (scrap) losses in aluminum founding has been studied by circulating a questionnaire to all aluminum foundries in the country and analyzing the data supplied; gathering existing scrap records from a number of foundries; inspecting the daily production of typical castings at different representative foundries; and investigating general conditions in the industry. The data and notes collected have been collated, analyzed, and summarized. In investigating the scrap records which have been kindly made available by foundry officials, the individual castings were studied with a view to determining the difficulties connected with their production. Comparison of casting losses in different foundries making the same type of castings will be made for the purpose of showing the variations in rejections; due consideration will be given in these comparisons for local conditions and variations in general design.

A questionnaire was sent to all firms known to melt aluminum alloys, whether in large or small amounts, and all plants mentioned as melting aluminum in *Penton's Foundry List,* 1918-1919, were included. This questionnaire was made up of 29 general questions some of which had a number of subdivisions. These questions touched upon the amount of output, composition of the alloy; average charge and weight of castings; percentage of castings rejected together with the per cent from the different causes of defects; kind of cores used; method of melting, including the kind of flux, if any; etc. Of the replies received only 64 contained data and some of the larger firms neglected to answer. However, the results of the questionnaire circulation were gratifying, and many of the foundries exhibited great interest in the investigation. The majority of the large representative foundries did supply data. Within the limits of reliability possible, it is believed that the losses reported by these foundries represent at least average practice for the country.

Necessarily, the data furnished varied widely in exactness, and in some cases they were rather vague because of the lack of adequate records. Reports as to the percentage of castings rejected on the foundry floor or in the inspection department varied considerably. In some cases, this variation was due to the type of castings produced, but in a number of the reports there was apparently a tendency to place the figures too low. This was shown to be so in some foundries by personal inspection of the daily production sheets over a sufficient period of time and by checking the inspection departments. However, from the data furnished and from actual examination of numerous records, it has been possible to arrive at what is believed to be a close approximation of the scrap losses in aluminum founding. Moreover, it has been possible to correlate these losses with fairly definite causes.

Suggestions For Prevention

Figures have been made available which show the loss tendencies in various foundries in relation to the determining factors. The causes for losses have been classified and discussed, and suggestions for the prevention of defects in castings are offered. Due to the fact that so many different kinds and types of castings are poured, the discussion, except in certain particular instances, is largely general, but the effort has been made to elucidate principles rather than specific details. The investigation has been confined practically entirely to sand-casting practice.

A complete study of the causes for

and the prevention of defects in castings, even in one individual foundry, is one which is beclouded with many difficulties, but it can be simplified by keeping detailed scrap records in which the defects in spoiled castings are classified. Defective castings can be classified readily according to the kind and amount of the defects, but it is more difficult to determine exactly why a certain defect occurred. The castings produced during a day's run in a foundry may be divided into good castings; castings with remediable defects which can be salvaged by welding, soldering, or other repairing; and totally defective castings. It is, of course, difficult at times to draw sharp lines of demarcation among good castings, those with remediable defects, and scrap castings.

Before taking up the classification of factors, as well as the individual defects which result in casting losses, an indication of the actual difficulties experienced in the production of aluminum-alloy castings will first be given.

Typical Defects

Numerous typical defects are recognized as of common occurrence in aluminum-alloy sand castings, and these defects are often so serious as to cause rejection of the castings. The more common and serious defects which lead to high casting losses will be discussed in the following paragraphs.

Cracks—Cracks in aluminum-alloy sand castings quite often cause high losses, particularly when a job is being put into production and before the molding has been worked out satisfactorily. They are associated with improper molding; wrong gating; too small, or an insufficient number of riser; chills left off when necessary; excessively hot-short alloys; and inferior aluminum ingot containing high silicon, and possibly high aluminum oxide. *Cracks may also be due to too high or too low pouring temperatures; too high copper content in No. 12 alloy; the presence of impurities (high iron); and hard ramming. ** They are more prevalent in castings of complicated design than in simple castings, because the core and the molding difficulties are more troublesome; but cracks are found in both complicated and simple castings, and are generally sufficient cause for rejection if large. Cracks in a crankcase usually cause rejection. Ordinarily it is not safe to repair cracks in a casting which must withstand any considerable stress. Chills, larger risers or shrink balls may help to eliminate them. The substitution of green-sand for dry-sand cores may also reduce the number of cracks, because normally cracks are fewer when green-sand cores are used, as for example body cores in crankcase production.

Draws—Draws are closely associated with cracks and are due to some of the same factors which cause cracks. Thus, draws may be the result of leaving out a chill; too high pouring temperature; inferior metal; wet sand; and ramming too hard. Where molding operations have been standardized on a large production job, hard ramming is not a usual factor unless green molders are being broken in. Draws may or may not be avoidable. They appear as depressions, shrinkage unevenness and *pinching in* of the metal. Shrinkage, shrinkage cracks, and draws are ascribed to the same causes. The British foundrymen and some foundrymen in the United States apparently regard cracks and draws as the same kind of a defect.*

Blows—Core blows and chill blows are generally considered to be allowable defects in aluminum founding, and it is apparent that they may or may not be avoidable. Core blows result from too hard cores, core paste not dry; and hot sand in the mold; that is, hot molding sand and a cold core. With the latter condition, moisture condenses on the cold core and the liquid metal will not lie quietly on a wet surface. Chill blows are due to wet and damp chills, and hot sand in contact with a cold chill; the result in the latter case is analogous to the condition where there is hot sand and a cold core. In the winter, in poorly heated foundries the chills may become *frosty*, and such chills should not be used as otherwise the casting will blow. Chill blows should be fewer when using dry-sand cores than with green-sand cores. The moisture content, or temper of the sand, is also a factor. Blows may be traced to their origin by observing their positions on the castings, but they should not be confused with actual internal blowholes. Blows appear as holes which may go entirely, or partially, through the casting, and as depressions and irregularities in the surface. Blown castings may be salvaged at times by welding or soldering provided the defect does not occur at a vital place in the casting.

Production Is Rushed

Broken Castings—Losses resulting from broken castings, whether broken in handling, trucking, chipping, cleaning, or welding, may be rather high in foundries where the production is rushed. Some breakage is undoubtedly the result of carelessness and rough handling, and this is avoidable. A number of foundries rush production at such a pace that carefulness is scarcely compatible with the speed attained. In many such foundries the castings are shaken out of the sand as soon as possible and removed from the floor to make room for more molds. If the castings are shaken out when too hot the loss will be high. A foundry making, say 500 crankcases a day, must have the best available mechanical and labor-saving devices, and the handling of castings by cranes at high speed is likely to increase breakage. Several castings will be transported together by crane, and if the crane sling slips and the castings fall to the floor from a height of several feet, all of them may be broken. Breakage is invariably lower in small foundries where the castings are handled by hand and wheelbarrow than in large foundries where they are moved by crane and electric trucks. Losses which result from breakage in chipping and handling during cleaning and inspection, depend upon the quality of the labor. Chipping, grinding, and cleaning are unskilled labor occupations, and breakage may be high at times because of the labor factor alone. Moreover, the job is a monotonous one and is not conducive to care on the part of the labor.

Supervision Is Necessary

Breakage attendant to knocking out core sand is normally low in all foundries unless the work is done by green men. As elsewhere, the labor-turnover factor has an effect on scrap losses from breakage. There appears to be no more breakage in knocking out core sand when using mechanical vibrators than when using hand hammers, and if anything, the former are to be preferred as the sand can be more quickly loosened by their use. In sawing off gates and risers, some small losses occur occasionally due to carelessness on the part of the band-saw operator who may accidentally saw into the casting. Losses from this factor are ordinarily classed as broken in chipping or cleaning. In the same way, some few losses result from grinding when the castings are ground too thin, or otherwise ground wrong. Such losses are due solely to carelessness, and can be minimized by supervision. Breakage on welding may result from rough handling when the castings are preheated prior to welding, or to cracking on cooling. Losses from this cause can be minimized by proper supervision, and by slow cooling of the castings after welding.

Sand and Sand Holes—The percentage of castings rejected beause of occluded sand particles, surface sand holes, and rough surfaces due to sand is fairly large. Defects which can be traced to sand are largely due to molding. Sand in the mold may result from a number

*Private communication, John G. A. Rhodin, London, England, Dec. 14, 1919.

**Collins, J. W., Suggestions for making aluminum castings, abstract of paper before the Detroit Foundrymen's association, in THE FOUNDRY, volume 42, 1914, pages 67-68.

*Hill, E. Carey, Aluminum: its use in the motor industry in England. *Metal Industry*, volume 16, 1918, pages 543-546.

of causes. It may be due to inadequate cleaning after slicking-up the mold and before closing; to sand knocked off the mold when setting cores; to loose sand dropping off the bottom surface of the cope on setting the copes or being knocked into the mold through a gate or riser hole after the cope is set; and to partial cope drop. Further, sand may be washed into the mold on pouring, and this possibility will be accentuated if the pouring is too fast or reckless. Sand from the cores also may cause castings to be rejected because of rough surfaces and sand holes, and it may be difficult on inspection to determine whether the sand holes are due to sand from the mold or to sand from the cores. Sand may appear in the castings, derived from the cores, because of dirty cores; or it may be abraded from the cores on setting, or washed from the cores on pouring. Core sand in the molds also is the result of rubbing the cores together on setting so that sand falls off and into the mold. Sand in the casting, attributable to the molds is largely avoidable, and it is possible to entirely prevent sand in the casting from the core. Given adequate core inspection, there is no excuse for setting dirty cores.

Misruns, Cold Shuts and Runouts

Under misruns, some foundries classify cold shuts and short pours. Cold shuts, are due simply to too low pouring temperature, and are dependent entirely upon pyrometric control after the correct pouring temperature for a given casting has been decided. Short pours are not of frequent occurrence in the case of repetitive jobs, but they do occur fairly often in small foundries and in jobbing shops making a variety of castings. In small foundries, mistakes in calculating the amount of metal necessary to fill the mold are largely the cause of short pours. Misruns and cold shuts are avoidable.

Runouts are due to improper clamping in the case of large boxes; to sand under the flask joints; and insufficient weights where weights are necessary. Runouts are avoidable, but occur from time to time largely because of carelessness.

Defects Due to Cores—Core shifts are frequent in the production of most types of castings, and are due to improper placing; sand under the prints; cores getting loose from their anchors; lack of chaplets; etc. They result in uneven walls, thin walls, and cut-through castings. Core shifts are largely avoidable. Some castings are scrapped because of cores set wrong or left out. Such faults are avoidable. Broken cores are the result of improper patching and rough handling. No broken cores should be set in a mold, but on fast production, the molder often does not have time to inspect the cores on setting them, and some broken cores are thus placed in the mold. In the same way, dirty cores, due to improper cleaning are set. The question of whether green-sand or dry-sand cores are to be used is one which is not generally agreed by aluminum foundries. Some founders use dry-sand cores exclusively, but others use green-sand cores wherever possible. Production costs are lowered by the use of green-sand cores where this is possible, and such cores possess certain definite advantages in aluminum founding.*

In the founding of motor crankcases it is necessary that the position of bosses, hubs, lugs, and other attachments shall be accurate. Such accuracy is more likely to be assured by the use of green-sand cores rather than dry-sand ones as the slightest swelling in a dry-sand core is accentuated in the casting. The unyielding nature of dry-sand cores is also likely to increase losses because of cracks, while the economy of the green-sand core makes it preferable.

Crushed and Broken Molds—Molds may be crushed on setting cores by improper clamping, when the bottom board * * is not placed correctly (not rubbed down); by the mold sagging because of dry sand; or by core sags. Extremely small crushes will result in scrap castings. Defects due to these causes are largely avoidable.

Cope Drop—Unexpected collapses of the cope, and partial cope drop when the cope is set on, invariably ruin the mold, but drops cannot usually be detected until after the casting is poured. Sand falling off the cope, or partial cope drops, cannot be detected until too late. These difficulties are usually charged to the molder. They are due to too soft ramming, improper cleaning, and rough handling when setting the cope.

Effect of Melting

Porosity, Blowholes and Unsoundness—These defects are markedly influenced by the melting temperature (because of gas absorption with increasing temperatures) and pouring temperatures, as well as length of time of melting. Blowholes are often confused with shrinkage holes and sand holes, and while there is not much difficulty in distinguishing these various defects in iron and steel castings, it is not always easy to do so in aluminum-alloy castings.

Pinholes*** are simply small blowholes and are due to the same causes—largely to gas absorption and overheating. A casting is said to be porous, or it leaks, when it shows inability to withstand pressure or when it shows seepage under the open methlyene-blue-gasoline test. Porosity may be due to pinholes, blowholes, cracks, or occluded foreign matter, or a combination of these. Unsoundness is a rather vague term used to denote a porous condition in a casting. Both actual blowholes and pinholes are the result of entrapped air or gas, and should be distinguished from draws and shrinkage holes which are the result of contraction of volume. The factors affecting the occurrence of blowholes, porosity, and unsoundness in aluminum-alloy castings have already been discussed.* These defects are largely avoidable. In the case of porosity in carburetors, leak-proof parts, and crankcases, the defect may not be detected until the castings are put under test—hydraulic pressure, air pressure, or open-gasoline—while in other castings the defect may never be detected.

Causes of Hard Spots

Hard Spots—The presence of hard inclusions in aluminum-alloy sand castings is not ordinarily observed during the routine inspection of castings in the foundry, and complaints because of this defect usually originate in the machine shop.** Briefly stated, hard spots are of two distinct kinds: nonmetallic hard spots and metallic hard spots. The former are due to charging foreign nonmetallic materials into the melting furnace, such as pieces of brick and stone, cement, core sand, molding sand, bits of crucibles, and other substances which become mixed with scrap, foundry-floor sweepings and sloppings. The latter are due largely to iron which may be traced to several distinct causes such as the use of secondary aluminum ingot with high iron content, or secondary aluminum-alloy ingot; charging core wire, nails, chills, iron or steel chips and drillings with the scrap; the dissolution of iron from cast-iron melting pots; and the hard, brittle, complex iron-aluminum alloy (iron-pot scale) which forms on the sides of cast-iron melting pots, and is knocked off into the melt on stirring or ladling.

Hard spots may be prevented by observing suitable precautions.*** Strictly speaking, losses due to machine-shop returns because of hard spots are rarely segregated from losses due to errors in machining in the production reports, and the figures for returns from the machine shop ordinarily do not permit analysis for the causes of scrappage.

*Anon., Use of green sand cores in aluminum work, THE FOUNDRY, volume 40, 1912, pages 141-146.

**Leary, W., Crush of the mold, THE FOUNDRY, volume 24, 1904, pages 165-166.

***Anderson, R. J., Blowholes, porosity, and unsoundness in aluminum-alloy castings, United States bureau of mines, technical paper No. 241, November, 1919; and Unsoundness in aluminum castings, THE FOUNDRY, volume 47, 1919, pages 579-584.

*Anderson, R. J., work cited.

**Anderson, R. J., Inclusions in aluminum-alloy sand castings, bureau of mines, technical paper No. —, 1920.

***Anderson, R. J., and Capps, J. H., Inclusions in aluminum-alloy sand castings, THE FOUNDRY, volume —, 1920, pages ——.

How and Why in Brass Founding

By Charles Vickers

Melting Loss Gages Furnaceman

We desire to learn if there is any estimated percentage of loss in producing castings of a composition of approximately copper, 85.70 parts; tin, 5.70 parts; zinc, 5.70 parts, and lead 5.70 parts.

The loss in making castings of the alloy given in the question will be the same as in the case of any red brass alloy. The investigation conducted some time ago by the bureau of mines in regard to losses in melting nonferrous metals showed an average loss of 2.5 per cent, equivalent to a loss of 5 per cent on metal bought. We take the following from the preface to the bulletin entitled, *Brass Foundry Practice in the United States.*

"There are in America today 3600 plants melting brass and bronze, and 1000 of these melt nonferrous alloys exclusively. The alloys of copper, zinc, tin, and lead, or other elements, in cast or wrought form, play an important role in our daily life. Allowing for the present recovery of waste metal, it appears that in current practice, between the purchase of the raw material and the completion of the finished product, at least 5 per cent of the original metal is lost. Zinc passes into the atmosphere through the furnace stack; the other metals in the alloy may be oxidized and pass into the stack, may be spilled in the furnace ashes, or in one way or another may not be completely recovered.

"In the melting of nonferrous alloys, taking into consideration all such alloys and all furnaces and fuels used, it is shown that from 90 to 95 per cent of the heat units in the fuel do no useful work. On the basis of $120,000,000 being the value of the metal passed through bronze and brass furnaces each year, a 2½ per cent melting loss, equivalent to 5 per cent loss on metal bought, means an annual loss of $3,000,000 in metal alone. Simply reducing the average loss to that of present best practice would mean a saving of over $1,500,000 a year. If fuel efficiency and crucible life could be brought from present average to best practice, half a million dollars more, at least, could be saved. That there is a wide lack of technical control is emphasized by reports of metal losses varying from 0.1 to 22 per cent, and fuel efficiency from 1½ to 16 per cent. The need for thorough technical control in the majority of our foundries and casting shops has been made evident by this investigation."

Applying this to the present question we see that by inefficient methods of melting and caring for the brass, as high as 22 per cent may be lost, with the average loss at 5 per cent and the minimum at 1½ per cent. The metal loss will depend upon what kind of a foundry we are running. If it is well and efficiently managed the metal loss will be considerably under 5 per cent, for 5 per cent loss is merely the common average. If the metal loss exceeds 5 per cent, no matter what opinion we may have concerning our own ability, we fall short of having average ability as a melter and the further we get from a 5 per cent loss, and the nearer to a 22 per cent loss the more evidence we furnish of our unfitness to melt brass.

Manganese Bronze Scrap

We have on hand a number of large manganese bronze castings that are to be scrapped. These castings were originally made from ingot manganese bronze and we would like to learn if they can be remelted and cast into good manganese bronze castings by adding the metals that have burnt out in the melting. We desire to know just what metals would burn out and the percentage that we may make the necessary additions, to produce castings as strong as the original metal.

The metals that oxidize or burn out are zinc, manganese, iron and aluminum. The last three mentioned will not decrease to a degree that will affect the properties of the alloy to any marked extent, and so they may be ignored. The loss of zinc however, is serious, but is easily remedied by adding more of this metal. If the manganese bronze is not flared excessively long in the furnace before it is poured, an addition of 2.5 per cent zinc will be ample on each remelt to retain the original physical properties of the manganese bronze castings that are to scrapped.

Formulas for Babbitt

We have a considerable quantity of babbitt metal to make and would appreciate your presenting us with a formula for a good high speed babbitt and also for a slow speed babbitt.

For high speed and high pressure use either of the following: Tin, 85 per cent; antimony, 10 per cent; copper, 5 per cent; or tin, 86 per cent; antimony, 12 per cent; copper, 2 per cent. For medium pressures and high speed use: Tin, 61.50 per cent; antimony, 10.50 per cent; copper, 3 per cent; lead, 25 per cent. For slow speed use: Lead, 80 per cent; tin, 5 per cent; antimony, 15 per cent.

Permanent Molds for Brass Castings

We are interested in gathering information regarding permanent molds as used in brass foundry practice. We have heard that in England such molds are being used successfully and produce some 8000 castings per mold before renewal. Any information you may give will be received with pleasure.

We doubt the truth of the statement that brass is being cast successfully in iron molds in England, or anywhere else, except in the case of special shapes that lend themselves to such methods. Several papers have been presented before the British foundrymen's association on the casting of brass in chill molds, but it appears that certain shapes can only be so cast. An editorial in the *Foundry Trade Journal* of London, England, March 1914 remarks, "In the course of a recent discussion on brass founding the question of casting brass in permanent molds came up; but the process did not appear to be familiar to British brass founders."

In the United States, blank gears of phosphor bronze are being cast in iron molds, and also in carbon molds. The latter sometimes last for 3000 heats. In this latter case the iron or carbon is used in conjunction with sand cores and sand portions of the mold. The alloy used in the so-called die-casting process is aluminum bronze, and gears with teeth cast in are being made successfully and in large quantity in metal molds. Also small castings of aluminum bronze are so cast.

Electric Furnace Has Proved Value

Simplicity of Construction, Great Flexibility and Comparatively Low Cost of Operation Are Some of the Advantages Claimed for a Rotating Type of Electric Brass Melting Furnace

BY CARL H. BOOTH

A RECENT survey of the casting industry, especially that branch devoted to the non-ferrous metals and alloys would seem to indicate that the electrical furnace is steadily finding favor as a melting medium. This is not surprising when a summary of its many advantages are taken into consideration. These include a clean, reducing, nonoxidizing atmosphere; superior working conditions with excessive heat and furnace gases at a minimum; any range of temperature obtainable, with simple methods of control—using pyrometer if desired; metal losses reduced to the lowest limits; and low labor and upkeep costs.

Fig. 1 is a line drawing showing the basic principles incorporated into the design of the furnace, and the simple electrical connections required. The doors are located at the axis of the shell where the electrodes enter the furnace. The pouring tap is located at one end, which leaves the cylindrical walls of the shell unbroken, permitting complete rotation of the furnace. The electrical current is brought into the furnace by the moving contact method similar to the third rail system employed in electric railway service.

All types and grades of copper alloys ranging from sweepings, grindings and low grade foundry washings up to the highest grade ingot metal and virgin pig have been melted successfully in this furnace.

In melting yellow brass turnings and borings, which are difficult to handle in any type of equipment, especially when full of dirt, oil and other foreign matter, the furnace is loaded well up on the walls at either side of the electrodes. The door is then closed, one or both of the electrodes withdrawn to permit of the burning oil and moisture escaping, and the furnace placed in rotation. As the borings tumble around inside of the furnace, new surfaces are constantly exposed to the hot lining, and the oil and dirt are rapidly burnt out. It is of course appreciated that the electric furnace is more valuable as a melting medium than used as a drying or oil burning vessel, and if the constant run of material charged is very heavy with oil, it will soon pay in saving in furnace time alone to remove the greater portion of oil before charging.

As soon as the flame from the burning oil drops off, the rotation is stopped, the electrodes inserted, the power thrown on and the melting started. The size of the charge will determine whether it is practical to commence complete rotation. If a maximum loading has been made, experience shows that equally good results can be obtained by leaving the furnace stationary for a brief period, and then advancing the shell forward occasionally to turn over the charge, finally going to complete rotation for 10 or 15 minutes before pouring. This method prevents any breakage of electrodes. If a smaller charge has been used rotation can be started immediately. The first method has the advantage in the using of the largest practical heats, resulting in the maximum daily output.

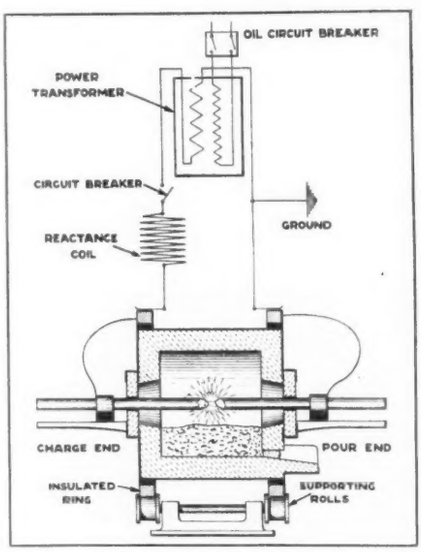


FIG. 1—DIAGRAM SHOWING BASIC PRINCIPLES OF FURNACE AND THE ELECTRICAL CONNECTIONS

The rotating electric furnace is especially adapted to treating or melting finely divided material. Since metals in this form can be purchased at the lowest possible cost, the furnace can show unusual economies when used on these grades of material.

Recent records obtained from the Prime Mfg. Co., Milwaukee, on a 500-pound furnace of this type which is used almost exclusively for the melting of yellow brass turnings and borings, pouring directly into castings, are shown in the accompanying table, No. I.

When melting brass turnings and borings all live parts of the furnace are cleaned carefully with compressed air after each heat. The movement of the electrodes through the cooling collars also is tested out to see that they do not stick. Any loose slag left in the furnace after pouring the heat is removed before recharging.

With heavier materials, such as heavy scrap, ingots, foundry returns, etc., the practice followed is to hold the furnace stationary after charging until the metal has softened, then partial rotation is started, and finally complete rotation.

It has become standard practice with these furnaces, to eliminate entirely the time usually consumed with heating up the furnace in the morning. Instead, where only one shift of eight or 10 hours per day is run, the furnace is charged at the end of the day for the first heat of the following day.

Records recently made on a 500-pound furnace at the plant of the Enterprise Brass Works, Muskegon, Mich., melting red and yellow brass for castings, in the proportions of about two-thirds red to one-third yellow, show what can be expected when using the furnace on heavy metal:

Average pounds melted daily	4800
Average charge per heat, pounds	600
Number heats per day—nine hours	8
Average power consumption per ton, kilowatt-hours	310

Records on the same size furnace at the plant of the Fulton-Harwood Brass Works, South Bend, Ind., indicate similar efficiency, although their daily average requirements for metal are less. The charge consists of virgin pig and local foundry scrap.

Yale & Towne Mfg. Co., Stamford, Conn., recently completed thorough

Abstracted from a paper presented at the convention of the American Foundrymen's association held at Columbus, O., Oct. 4-8, 1920. The author, Carl H. Booth, is president of the Booth Electric Furnace Co., Chicago.

tests covering every phase of the operation of a 500-pound furnace at their plant. A high pouring temperature is required due to the light weight castings made, and likewise the time between heats is lengthened out since the metal is all taken in small pots. As a consequence it was necessary to keep the power on the furnace while pouring which made the power consumption high and slightly increased the metal loss. There were other disadvantages in handling due to the location of the furnace, but when the practice in this foundry is thoroughly worked out much better records can be made. The analysis of the metal melted was: Copper 86.93; zinc, 9.62; tin, 1.86; lead, 1.38; and iron, 0.21 per cent. The summary of the test data is shown in the accompanying table, No. II.

Metal Loss Is Low

The analysis made of metal before and after pouring showed that the loss was mostly zinc, and that the actual value of same was $2.43 per ton melted. Examination of the castings made from the metal melted in the furnace showed that there were no rejections due to the metal. With reference to the high power consumption shown, especially on June 1, 7 and 15, the statement is made that this was materially increased by the shortage of labor, as heats had to be held from 10 to 25 minutes until men were available to carry the metal, whereas the results of May 25 and June 8 show the increased capacity and decreased kilowatt-hours per ton due to elimination of these delays.

It is significant that even with a rate for power, in practically all of these plants, of at least 2 cents per kilowatt-hour, and occasionally up to 3 cents, the cost for electricity per ton of metal melted is no higher than present day costs for coke, coal, oil and gas. As the use of crucibles for melting is eliminated with the Booth furnace, and the total upkeep and repair costs on this small 500-pound furnace will not average over $2 per ton of metal melted—considerably lower than the cost of crucibles alone—the large savings made in metal losses and in labor show a margin in favor of the furnace.

The records presented show that it is practical to use a small arc furnace for intermittent daily operation and secure cost records almost as low as with larger size furnaces. The overall result is far superior due the greater flexibility in handling and the ability to make short heats; to follow one heat of a certain mixture with another heat of an entirely different analysis; to run, if necessary, only a few hours per day but not at a heavy penalty in cost; to use any grade of material from borings to pig metal; and thus to effect the maximum economy in metal used.

A recent day's run on a 250 pound furnace at the plant of the Hill Pump Valve Co., Chicago is illustrated in the table No. III.

Many heats on yellow brass scrap have shown as low a power consumption as 240 kilowatt-hours per ton, while on yellow brass turnings and borings, 210 kilowatt-hours per ton has not been uncommon. Linings have lasted almost 900 heats and none less than 600. This represents a cost of less than 10 cents per heat; conservatively 75 cents per ton. Accurate weighing of electrodes each day shows only 3½ to 4 pounds consumption per ton of metal, including breakage. Shrinkage has not averaged over three-fourths of 1 per cent on red brass, nor more than 1.4 per cent on yellow. Heats as small as 100 pounds have been made showing only a slightly higher average for all items than when run to rated capacity. The most efficient basis naturally is to charge a maximum of metal per heat, which for this furnace would be approximately 380 pounds.

Making Special Mixtures

Nordyke & Marmon Co., Indianapolis, Ind., is using one of these 250-pound furnaces for making difficult alloys and castings, including silicon bronze and other special mixtures. A considerable portion of the time, the furnace runs for 16 hours per day. Many heats of red brass on this basis have been made at the rate of 270 kilowatt-hours per ton, which is a good record for a 200-pound furnace.

Data secured in connection with the operation of a 2000 pound furnace at the plant of the Michigan Smelting & Refining Co., Detroit, indicate that the same speed of melting is obtained with the large furnace

FIG. 2—VIEW OF 500-POUND FURNACE AT PLANT OF FULTON-HARWOOD BRASS WORKS, SOUTH BEND, IND.

Table I

Pounds melted per day (one shift)	3900–5500
Average daily output, pounds	4950
Average daily charge, per heat, pounds	550
Number of heats per day	8–10
Number of hours power on furnace daily	10–11
Average melting time, minutes	40
Time between heats, minutes	15–25
Average power consumption per ton, kilowatt-hours	300

Lining (made of good grade of arch fire clay brick) has lasted approximately 500 heats, and is good for many more.

Electrode consumption per ton metal, under 6 pounds.

No records as to net metallic shrinkage, exclusive of oil, dirt and moisture are available, but careful tests made on the same type and analysis of material in other Booth furnaces show that this need not exceed an average of 2 per cent.

Table II

Date 1920	Heats	Charge pounds	Melt time min.	K. W. H. to hold heat	Total K. W. H. used	Total time min.	Delay minute		Mteal poured pounds
5/25	7	4060	317	69.8	712 4	552	7		*
6/1	5	3045	292	60.0	729.8	538	22		3007.5
6/7	4	2436	295	38.0	644.2	530	50		2391.0
6/8	7	4263	363	0.0	783.8	608	41		4209.5
6/14	6	3654	305	13.0	791.2	545	21		3620.5
6/15	5	3045	254	51.0	595.0	501	38		3010.5
6	34	20503	1826	232.6	4256.4	3274	174		16239.0
Average per ton			178		22.7	415.2	319	16.9	
Average per heat			53.7			96.2	5.1		

*Box of gates missing.

Amount of metal melted in six working days, pounds	20,503
Number of heats	34
Average weight of heat, pounds	603
Total working time, hours	54.6
Average time per heat, minutes	96.2
Average melting time per heat, minutes	53.7
Average time between heats, minutes	37.4
Average metal melted per day, pounds	3,417
Average kilowatt-hours per ton	437.9
Average electrode consumption per ton, pounds	6.55*
Gross shrinkage, per cent	1.24
Nonmetal in charge, per cent (approximately)	0.13
Net metal loss, per cent	1.11

*2.8-pound nipples.

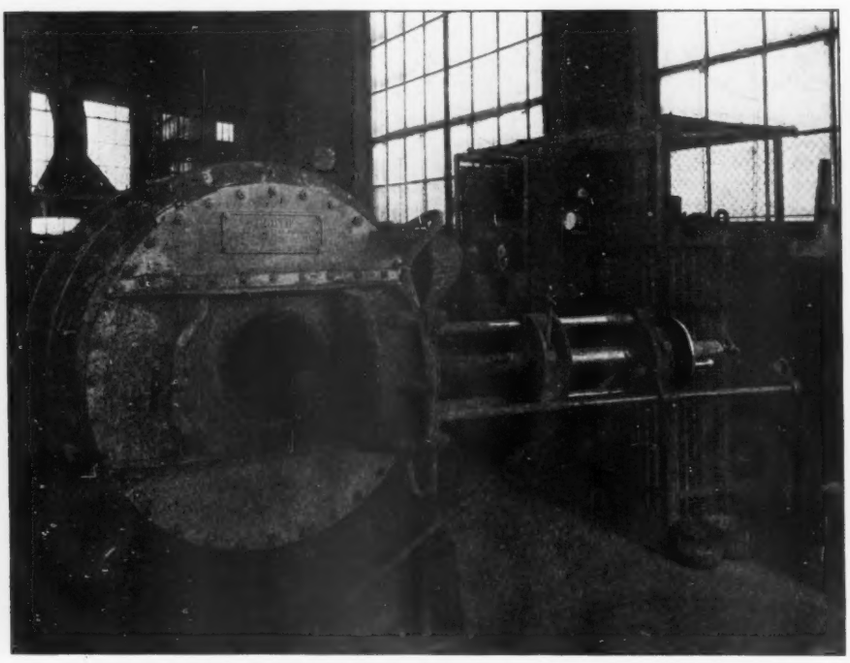


FIG. 3—REAR VIEW OF SAME FURNACE SHOWN IN FIG. 2

as with the small sizes. This foundry reports that some of the heats have run as low as 240 kilowatt hours per ton.

This 2000-pound furnace at Detroit is the first electric melting furnace of the indirect arc, drum-type method of construction to be equipped with automatic electrode control. Before this was placed in operation it was freely predicted that such apparatus could not be used successfully, that the electrodes would stick and that there were peculiar short-circuiting conditions in the furnace caused by zinc and other metallic vapors which would make it inoperative. Notwithstanding these predictions, the automatic control feature has worked without any difficulty from the very first heat made in the furnace, and for the largest portion of the time the furnace has been melting extremely dirty and oily yellow brass turnings and borings. A small ¼-horsepower, direct current, ball-bearing motor, controlled by a standard control panel comprises the equipment. Either 220 or 110-volt direct current can be used.

The possibilities of automatic control as regards ease in handling a battery of furnaces, may be likened to other methods now used in progressive plants with recording pyrometers in the control and regulation of heat treating and other similar furnaces. It does not take a serious stretch of the imagination to conceive of the application of much the same plan to the control and operation of a battery of Booth furnaces equipped with this practical and efficient device. On such a basis, the control panels for all the furnaces might properly be located at one central position, most convenient for constant observation by the melting superintendent. These would be appropriately numbered referring to the different furnaces in order. In conjunction with these panels would also be mounted the registering clock-type watthour meter and indicating ammeter, and a supplementary push button or starting box controlling the rotating motors for each of the furnace units. The melting superintendent could then easily take care of each furnace operation, much as a train despatcher handles trains, without the necessity of leaving his central position at any time. One or two assistants could supervise and help with the charging, leaving his entire time free for studying out the most efficient schedule for each heat. No records are yet available showing what results can be secured when operating the different sizes of furnaces on a 24-hour schedule. The tests herein recorded are all on a basis of one shift averaging nine to ten hours, including all time for preheating.

Eliminating from consideration the first heat of the day, and allowing an average of 25 minutes between heats,

Table III

All Heats Were Red Brass 85-5-5-5

Heat No.	Power On	Power Off	K. W H. used	Weight of charge pounds	Time between heats, min
1	6:00	8:35	125	346	...
2	9:00	9:58	50	348	25
3	10:22	11:25	52	351	24
4	11:48	12:50	52	340	23
5	1:15	2:15	50	362	25
6	2:40	3:40	53	384	25
7	4:07	5:00	48	371	27
			430	2502	

Average power consumption—343 Kilowatt-hours per ton (no preheating required).
Notes:—
On each heat from three to five minutes taken to skim through door. Zinc added at this time.
Metal used: Old scrap copper (bearing blocks).
Pouring time: Ten to twelve minutes between heats.
Re Eainder: Clean electrodes and coolers, and charging furnace.

the data show that the 250-pound furnace would have a total daily output of at least 6000 pounds, and an average power consumption of 285 kilowatt-hours per ton on red brass and 235 kilowatt hours per ton on yellow brass. With the 500-pound furnace, the output would reach 12,000 pounds, and the average power consumption on red brass would run 275 kilowatt-hours per ton, and on yellow brass 225 kilowatt-hours per ton. The 2000-pound furnace should show a daily output of 48,000 pounds, with an average power consumption on red brass of 250 kilowatt-hours per ton, and on yellow brass of 210 kilowatt-hours per ton.

Furnace Shell Insulated

No 1000-pound furnaces have yet been placed in operation, although a number have been shipped, and results soon will be available.

The two one-piece heavy metal tracks on which the melting chamber revolves are specially designed strong castings with ample cross-section, in the 250 and 500-pound sizes, to carry all the electricity required for melting the metallic charge. In all sizes above 500 pounds in holding capacity, two additional copper rings, completely encircling the melting chamber, are provided to carry the electricity, and in these sizes no current flows through the tracks. In both cases the current carrying members are insulated from the furnace shell so that no leakage can occur.

Between the two rollers on which the tracks rest, to the front and rear ends of the drum, two shoes, or contact surfaces, are located, pressing at all times closely against the tracks, or collector rings, held always in position by a strong adjustable spring. The cables or bushbar from the transformer come through conduits in the floor to a point approximately in the center of the floor under the furnace, and from there spread out to the terminals of the shoes on either side. The position of the shoes, on all sizes, is purposely placed back from the ends of the drum, so that nothing can spill on them, or interfere with making a good electrical connection.

The positive friction drive used has proved to be very efficient. The two rollers on the side next to the motor, provided for rotating the furnace, are connected by a common driving shaft, which is then connected to the motor through worm gear reduction, running in oil, and a flexible coupling. Grease cups are provided for all bearings. The shaft joining the idler rollers on the opposite side of the furnace runs through a bearing pivoted at the center, which insures that all the rollers engage uniformly with their respective tracks. The friction drive improves as the parts wear.

No special foundation or setting is needed for the furnace. The rollers, gear reduction and motor, push button control and water connections are mounted on the one-piece cast iron base which is designed of the proper proportions so that the charging door and pouring spout are at the correct height from the floor. Any flat, level surface, substantial enough to carry the weight of the furnace, is sufficient. Provision is made for foundation bolts for imbedding in concrete if desired. Because of the base being all in one piece, the erection of the furnace is greatly simplified, as is also the moving and setting up of the furnace in another location at any time.

Fig. 5—Control panels for a 2000-pound furnace. The electrode control panel is on the left while on the right is shown a clock-type kilowatt-hour meter and an ammeter for controlling the current

The only place where water jackets or cooling is employed is the point where each of the two electrodes enters the melting chamber. The cooling collar is made of welded steel plate, and sufficient clearance is allowed for the passage of the electrode so that it does not need to be machined. As a result little difficulty is had with sticking electrodes. One valuable feature of this steel collar is the ease with which it can be repaired. Any leaks developing can be quickly welded. The electrodes enter the furnace through the charging doors, the opening of which provides a quick method at any time for removing a broken electrode or replacing a water collar. The water pipes leading to the collars are made part of the furnace mechanism, swivel and rotating joints being provided to take care of all movements so that there are no delays due to changing of water connections.

One of the special features of the furnace is the simplicity of the lining. Complete repairs can be made quickly, not more than 24 hours being needed from the time the last heat is taken until the new lining is in place and the furnace ready to run. Advantage is taken of the drum-type construction of the shell, so that by removing either end section by simply unbolting from the shell, the new lining can be quickly slipped into the place. This lining comes in three or four pieces (in addition to the one brick required for each door), including either one or two big circular brick for the cylinder itself, and one brick on each end. The simplest manner of putting the lining in place is to turn the shell up on end like a barrel, lower each section of the lining into position, then tamp the heat-insulating material into place between the lining and the shell. This is to all intents and purposes a one-piece lining, which makes it practically impossible for the melted brass to work its way back to the shell, impregnating the entire lining.

The entire lining, due to the complete rotation of the furnace, is covered by the metal bath, resulting in even wear and expansion of refractories, long life for the same grade of material, and low repair costs.

The complete rotation of the furnace also insures even heating of the metal bath, as the metal absorbs heat not only by radiation from the arc but also from the passage of the hot lining beneath it.

No special stirring of the molten metal is required in the ladle, as rotation produces a homogeneous metal, even in the case of high lead mixtures. Where exceptional mixing action is required, special fluted linings are furnished.

Charging and Tapping

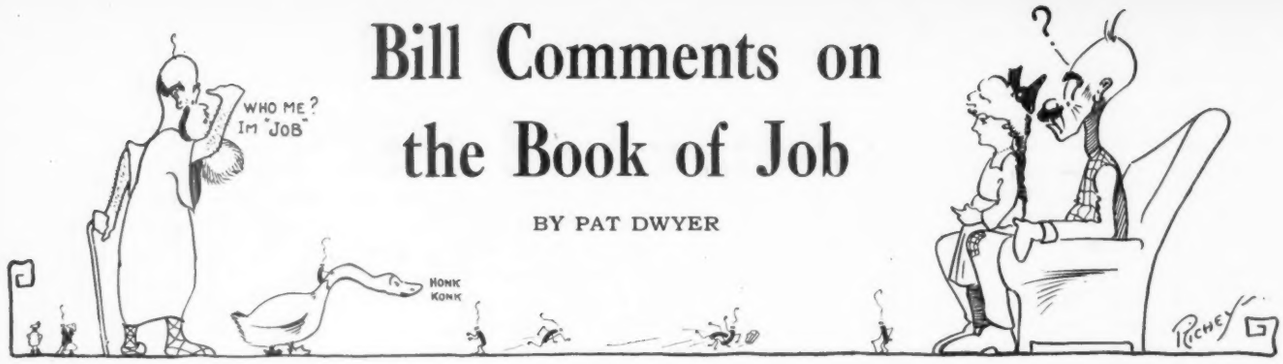
The charging door of the furnace is located at the opposite end from the tapping spout. If a battery of furnaces is installed, it is a great deal more convenient and economical both in the labor cost and the handling of materials, to have the charging operations all carried on at one end of the furnace, entirely apart from the tapping and pouring. This also saves floor space, as the furnaces can be located very close together under this arrangement.

For use in rolling mills, smelting plants and foundries where elimination of double pouring is necessary, special tapping arrangements are provided for pouring direct from the furnace into molds, the pouring tap remaining stationary, and at a fixed point.

(*Concluded on page* 1004)

Bill Comments on the Book of Job

BY PAT DWYER



LITTLE realizing how near she was to battle, murder and sudden death, a certain young lady calmly approached my chair one night recently and removed from my hand the book that I was reading. She then perched on one arm of the chair and having disposed one of her arms in a strategic position, known I believe in sporting circles as a *half neison*, around my neck, she sweetly announced that she needed some help.

"We have to write a 300 word description of the story of Job" said she, "and I wish you would help me, you know all about those old birds."

I pointed out to her in a proper parental manner that her ways were rough, that her grammar was atrocious and her style of speech when referring to the ancient patriarchs made me wonder to what the world was coming. However, I told her that if she wrote the story I should be pleased to look it over and suggest any necessary changes. The idea did not appeal to her.

"I'll tell you what we'll do," said she. "Let's go fifty-fifty on this thing. You write the story first and then I shall take and copy it in my own writing."

I curled one arm around her as an indication of how I detested her company and said that I should have to look up the Book of Job in order to refresh my memory. "However," I said, "Confidentially speaking as between man and beast, I don't think that Job had anything on me, at least I never have read in his book of lamentations that he had to do his children's home work for them." I also told her with becoming modesty that when I was going to school I was not a thorn in my parents side but worked all my problems out by myself. I don't know just how far I might have gone in perjuring my immortal soul, if she had not said that she intended to check up that statement the first time she visited her grandmother.

Fortunately at this embarrassing moment Bill appeared in our midst and politely expressed the hope that we were all enjoying our usual health and strength "Glory be to God". I assured him that we were getting fat and saucy and then told him about the shameless manner in which a certain young lady, not mentioning any names, of course, had tried to pass the buck on me.

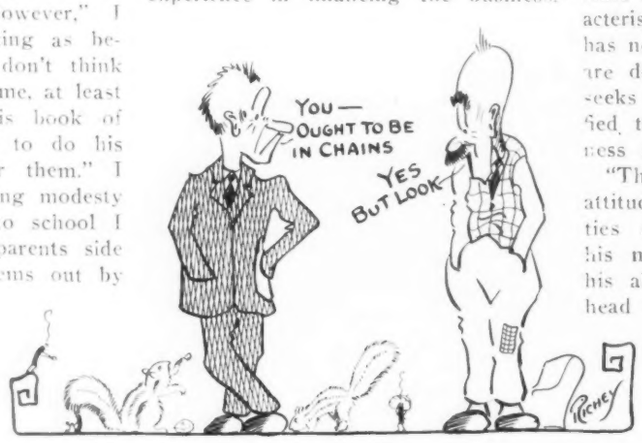
"Job certainly had his troubles" said Bill. "He lost his flocks and herds; he lost his children; he lost his first set of wives and his first set of teeth and he had the most embarrassing set of boils on record; but he never ran a foundry and suffered the affliction of seeing the same casting lost day after day for want of knowledge on his part of how to cure the trouble."

"Another thing," said he, "that peculiar trait of human nature so neatly described in the phrase 'Let George do it' is not confined to any one class of human beings or restricted in its application to any one form of human endeavor. You can see it everywhere, in the home, in the shop and in our civic and national affairs. For instance consider the foundry business. The foreman, as a general rule knows little, and cares less for the responsibilities of the owners, or of the difficulties they may experience in financing the business. The problems of the sales agent in securing a market for the product of the plant and then holding that market in the face of active competition are not considered. If the idea ever occurs to him, he dismisses it with the philosophical reflection that it is none of his business.

"The troubles of the purchasing agent in his endeavor to keep the plant supplied with raw material and keep inside his appropriation in the face of traffic congestion, rail embargoes, soaring costs of every conceivable commodity, go completely over his head. If a shipment of material fails to arrive on time or if a supply of pig iron or coke different from that usually employed is brought into the plant he rends his garments, throws ashes on his head and profanely declares in the presence and hearing of all that if he had an axe and was allowed the freedom of the general office for five minutes, yes, three minutes, there would be one less purchasing agent contaminating the earth with his presence.

"He has been placed in charge of a certain number of men and is expected to turn out a definite tonnage of castings; but he expects some one else to furnish the men and provide the material and if these factors are not forthcoming he may lose his temper or he may not, depending on his state of mind and other natural characteristics; but generally speaking he has no conception of how these things are done and what is more he rarely seeks to be enlightened. He is satisfied to think it is none of his business and lets it go at that.

"The molder maintains a similar attitude toward the foreman, his duties and responsibilities. He makes his molds according to the best of his ability but once the cope is on, head built up and clamps tightened his interest ceases. He neither knows nor cares how the iron is melted and the analysis and physical characteristics do not concern him at all. The foreman directs that the mould be



IT IS FAIRLY EVIDENT THAT BILL IS A HARD NUT

ALLOYS OF INTEREST TO BRASS FOUNDRYMEN

NONFERROUS ALLOYS RECENTLY PATENTED

Alloys for Lead-Coating Iron and Steel

The object of these alloys is to form a protective coating for iron and steel. The alloys are claimed to protect the iron as they are designed so they are not electropositive to the same. Three alloys are given under patent No. 1168663. The patentees are Clayton Mark Jr., and Clarence Mark. The alloys follow:

1	Per Cent	2	Per Cent	3	Per Cent
Lead	98.00	Lead	92.00	Lead	86.00
Zinc	1.00	Zinc	3.50	Zinc	6.00
Antimony	1.00	Antimony	4.50	Antimony	8.00

Sheathing Metal

A metal for sheathing hulls of vessels, and which it is claimed is also suitable for making piston rods, valve stems, shell bands and bearings has been patented by J. Monville, Patent No. 1199200. The alloy follows:

	Per Cent
Copper	95.500
Iron	3.000
Tin	0.625
Zinc	0.625
Nickel	0.625

Alloy for Springs

An alloy suitable for the springs of watches has been patented by G. E. Guillaume, Patent No. 1106206. The alloy follows:

	Per Cent
Iron	66.20
Nickel	28.50
Silicon	0.30
Chromium	1.50
Tungsten	1.00
Manganese	2.00
Carbon	0.50–100%

ALLOYS OF INTEREST TO BRASS FOUNDRYMEN

NONFERROUS ALLOYS RECENTLY PATENTED

Nonmagnetic Alloy

An alloy that is claimed to be nonmagnetic, and is suitable for cutting tools, as it can be tempered, is the subject of a patent by J. A. Douglas. The patent was taken out in Great Britain. No. 8331. The alloy follows:

	Per Cent
Nickel	60.00
Copper	28.00
Ferromanganese	3.00
Aluminum	4.00
Tin	5.00

Also ferrosilicon, chromium and tungsten may be added as convenient.

Babbitts

Two alloys for babbitting have been patented in Great Britain by C. Billington, No. 11138. The alloys follow:

1	Per Cent	2	Per Cent
Tin	84.00	Tin	74.00
Antimony	9.00	Antimony	9.75
Copper	6.00	Copper	5.00
Nickel	1.00	Nickel	1.25
Lead	none	Lead	10.00

Packing Rings

An alloy for packing rings that will withstand superheated steam has been patented by G. E. Holder; U. S. Patent, No. 1127624. The proportions are approximate.

	Per Cent
Copper	20.00
Nickel	15.00
Lead	65.00

Brake Band Linings

An alloy for brake band linings, has been patented by Mary Holden, U. S. Patent, No. 1203338. The proportions are approximate.

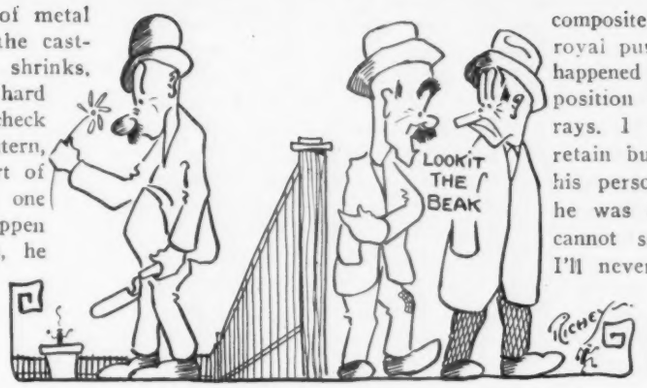
	Per Cent
Lead	63.50
Copper	36.00
Phosphor copper	0.50

Note—This sheet may cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

THE FOUNDRY DATA SHEET, DECEMBER 15, 1920

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

poured from a certain ladle of metal and the molder pours it. If the casting is poured short, if it shrinks, warps, or cracks, if it is too hard or too soft, if it does not check up with the blue print or pattern, if the flask or some other part of the rigging breaks or if any one of a hundred and one things happen which cause defective castings, he does not worry so long as it cannot be blamed on faulty molding practice. He is willing to assume responsibility as far as the mold is concerned; but all the other hazards are directly up to the foreman and the molder cheerfully allows him to do the worrying."



AS A PERENNIAL BLOOMER HIS NOSE WAS A PRIZE WINNER

"That's all old stuff," I said, "and anyway why *should* the molder bother his head about things over which he has absolutely no control? Suppose for the sake of the argument he studied chemistry and metallurgy, what good does it do him? Any suggestions he may make are not received with favor either by the foreman or the furnaceman. The former resents the advice as being a reflection on his capability and the latter will only take advice, suggestions or orders from some duly qualified person in authority. In fact some of these old hard shell melters will not even do that."

"'Pon my word," said Bill, "I sometimes think your people should appoint a guardian to go around with you. Some bold, wicked person will steal you some day while you are dreaming and sell you to a museum or a glue factory or something of that kind. You are just the same as the majority of molders. You think it is time enough to learn some of the things a foreman should know after you secure a job as a foreman. Did it ever occur to you that education is no load to carry around and the way to get a job a little better than the one you have is to learn something about that job in advance? You may not have occasion to use all your knowledge the first day you take hold of the new job; but you can rest assured it will come in handy some day. If you feel like giving me your undivided attention for a few minutes I shall relate a chapter from my own experience covering this point.

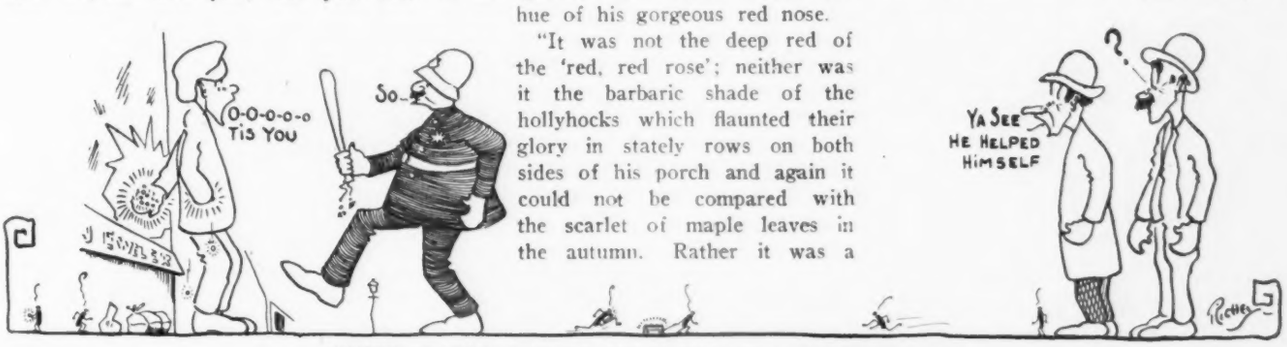
"I blew into Cleveland about 6 o'clock one morning a good many years ago and before noon had secured a job in a shop down on the *Flats* and north of the old Superior viaduct. The foreman had all the men he wanted on the crane floor and offered me a job in the dog house. The job did not appeal to me but the country was just recovering from one of its periodical panics and it was a case of any port in a storm. I have many reasons for remembering that shop and yet the first thing that comes in my mind whenever I see or hear the word Cleveland is a picture of the man who worked on the floor next to me.

"He was a pleasant old Dutchman and spent all his time around his house, where I had the pleasure of visiting him a few times, in working in his garden. He may have had a tender heart and it is possible and indeed quite probable that he had the soul of a poet for he was forever fussing among his flowers and shrubs and when he was not busy attending them in person he was talking about them. The reason I remember him so vividly is not because of his horticultural proclivities; but because there was not a rose, a peony or a dahlia in his garden that could match the hue of his gorgeous red nose.

"It was not the deep red of the 'red, red rose'; neither was it the barbaric shade of the hollyhocks which flaunted their glory in stately rows on both sides of his porch and again it could not be compared with the scarlet of maple leaves in the autumn. Rather it was a composite of all three with a hint of royal purple shining through when he happened to stand in a certain relative position to the direction of the sun's rays. I have forgotten his name; I retain but a very hazy impression of his personal appearance and whether he was 30 years old or 60 I really cannot say but that nose! Oh boy! I'll never forget it.

"He was a nice easy going old fellow with a placid mind like a cow. Of course it never has been definitely proved that a cow has a mind; but what I mean is that his mind was the kind you would expect a cow to have if a cow *had* a mind. He had worked in that same shop for a great many years and apparently was perfectly contented and since happiness is simply a state of mind who shall say that his life was not more successful than that of men who lose their health and their youth in the mad scramble for wealth and power?

"However, let us get on with the work. I had been in the shop for a few months, the Dutchman and I each were given a small truck wheel pattern with an order to make 100 castings. The mold was made up of a cope, a drag and a chill and we experienced no difficulty in putting up the day's work. We shook them out after they were cast and when we came in to work on the following morning we found every wheel split in two or more places. The next lot we made by the foreman's orders were left in the flasks all night. They cracked just the same. We then were advised to dig out the center core and leave the casting in the flask. That did not stop the wheels from cracking. The foreman then decided that he would anneal them. Accordingly after the wheels were cast we had to shake them out and drop them into upright salamanders containing a coke fire in the bottom and a quantity of coke between each pair of wheels. On the following morning we found a perfect mess in the salamanders. Three or four of the wheels had part-



ANOTHER OF THOSE DEAR OLD GOLDEN TEXTS IS KNOCKED FOR A GOAL

ly melted and fused together and the remainder had cracked as usual. Did Dutchy and I worry over these things? We did not—not even when the order was canceled and the patterns taken to another shop. Even the shipping clerk viewed the matter with indifference. When he came to our floors for the patterns he said flippantly, 'The Lord giveth and the Lord taketh away, where's them there wheels?'

"An interval of five years is supposed to elapse and then we find our hero the present speaker in charge of a foundry on the eastern seaboard. An order came in for a lot of wheels similar to the one I have been describing and do you know I went through practically every one of the same experiments before I decided to go where I should have gone in the first place and told the manager it was impossible to make chilled wheels with the available iron. He was doubtful. The iron was good iron, at least he had paid enough for it and he thought that if I were to fire the man who was making the wheels the next man would be more careful. Can you beat it?

"We were supplied with pig iron and coke by a neighboring steel works. Both were high in sulphur and in addition the iron was abnormally high in phosphorus and you can readily see that while it was good enough for the ordinary run of castings it was totally unsuitable for such tricky castings as chilled wheels. The nearest bessemer or malleable iron market was over a thousand miles away and that meant that it would take a month at least to get a carload. The ingot molds employed at the steel works had been imported from England and were made from a hematite iron which approached the bessemer iron in this country. The manager got in touch with the steel works people and they sent over a carload of ingot mold scrap. We charged enough of this material each day to pour the wheels and had no more trouble with them through cracking. The tread of the wheel did not chill white but it was sufficiently hard to stand up to the usual service required of such wheels.

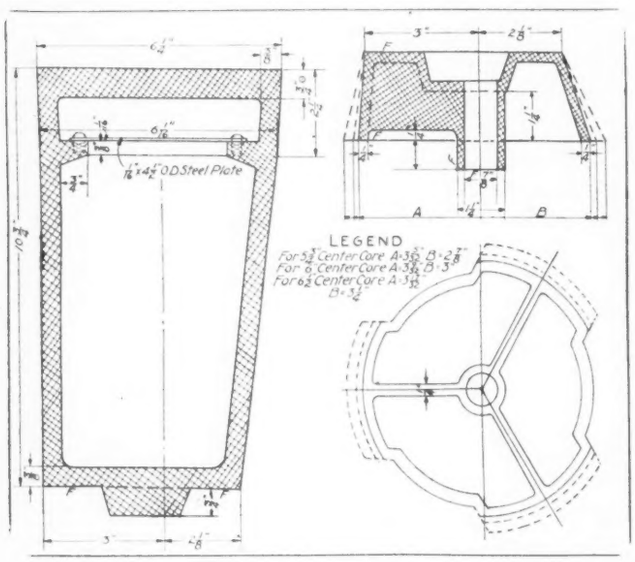
" 'The Lord giveth and the Lord taketh away' may have been considered a snappy slogan in the ancient land of Uz," said Bill, "but believe me when it comes to getting results 'The Lord helps those who help themselves has it beat a mile.' "

Invents Pouring Head and Skim Gate

AN IMPROVED type of pouring head and skim gate particularly applicable in the molding of car wheels, but which may be adapted to any class of castings and shown in the accompanying illustration has recently been patented by W. J. Alford, Birmingham, Ala. It is already in use in several car wheel foundries and the inventor claims that the chipping expense in those shops has been reduced 75 per cent. It eliminates the use of collar cores and dry sand basins and practically insures a solid hub. Other claims made for the device are that it enables the molder to put up two or three additional molds a day; the amount of metal in each pouring head is reduced to approximately 20 pounds and finally it is said that the entire saving on each wheel as compared with former methods amounts to from 10 to 13 cents each.

The device consists of two parts, the top center core print and a plug to ram the head sand against. The details of construction of the core print and plug for making the pouring basin are shown in Fig. 1, while the application of the device is shown in Fig. 2. The core print is provided with three projections which leave three openings around the top of the center core after the mold is closed. The top of the center core also forms the bottom of the pouring basin. The slug used in ramming the pouring heads is fluted on three sides to correspond to the gaps in the core print. The flutes do not extend from top to bottom. They are full size at the bottom where they coincide with the core print but gradually taper off so that the plug is perfectly round before it reaches the top.

The gates are narrow in cross section and therefore act as strainers and being located close to the center core do not need to be chipped closely as the operation of boring out the wheel later disposes of any stumps that may be left on. They simply are knocked off with a hammer.



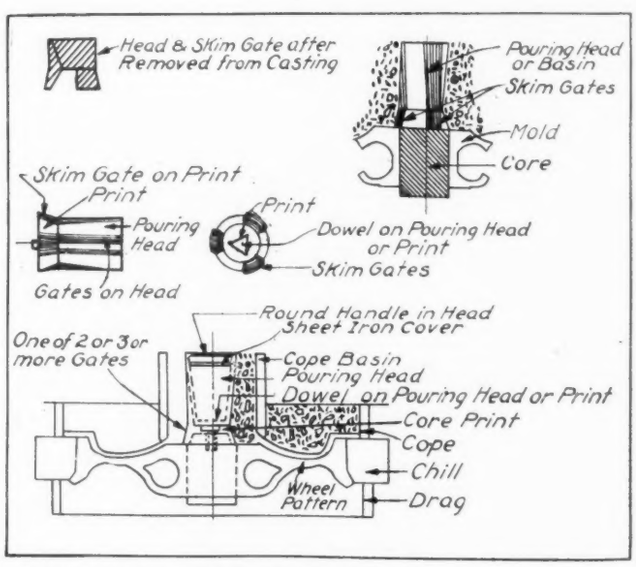


FIG. 1—THE EXTENSIONS ON THE SIDES OF THE CORE PRINT SERVE AS GATES—FLUTES ON THE SIDES OF THE RUNNER PLUG COINCIDE WITH THOSE ON THE PRINT—A TRIANGULAR DOWEL AND DOWEL PIN LOCATE THEM IN THEIR PROPER RELATIVE POSITION FIG. 2—SECTIONAL VIEW OF ASSEMBLED MOLD BEFORE THE COPE IS LIFTED OFF, OR THE PLUG WITHDRAWN FROM THE RUNNER HEAD

Adopt Methods to Develop Foremen

A Detailed Description of a Foreman's Development Course Which Was Conducted During Six Months of Last Fall and Winter at the Plants of the International Harvester Co.

BY M. C. EVANS

THE foreman of today often is misunderstood and in many cases possesses sterling qualities that are under-rated. His position in the past has been one in which he has had to think principally in terms of production, quality and cost with very little thought of the personnel problems that are so important today. His rise was gradual.

He went from apprenticeship to a master workman, and then, due to the fact that he was a superior workman, he became assistant foreman and finally foreman of the department. He was often referred to as "Boss" and his word was taken as law by those who worked under him. Such a man earned his promotion through sheer ability to do his job better than the other fellow, but often, however, proved to be an absolute failure as head of a department.

The average foreman is beginning to realize that a trained mind is perhaps the most important qualification for success in the industrial world; a general realization of this will give us a basis for the training of any man in an industrial concern. It is true that often men become highly skilled and trained in their profession, that keen competition comes, and that a few rise above the others to positions of high importance in the company. This naturally has a tendency toward upgrading and a higher standard of organization will naturally tend to put any company in the lead in spite of competition.

My sympathies are with the foremen. I believe that in the past many companies have failed to recognize the true value of the most important man in their producing organization—the foreman. To the workman in the shop the foreman is the company, and through him they learn the policies and wishes of the management. Their respect and loyalty for the company will gain with the good salesmanship of the foreman.

Many foremen have the feeling that they are not really a part of the management of the company. Where they have this consciousness, it is certain that they are not able to transmit properly the attitude, views and policies of the company to the working men, and this, after all, is one of the most important duties of any foreman—to be the man in between the working man and the management. He has been rightfully called the key-man in industry. And if he is the key-man in industry, can we imagine that time is wasted in training him so that he will properly represent the management to the men, or on the other hand, reflect to the management the attitude of the men under him? Anything that will help to strengthen the foremen in this relation should be encouraged.

In my estimation, some of the characteristics necessary for good foremanship today may be classified under the following headings:

(a) The foreman should have leadership and personality.
(b) He should be a keen student of human nature.
(c) He should have a knowledge of company policies and ability in order to properly transmit them to his men.
(d) Also knowledge of his work and methods of manufacture.
(e) And knowledge of methods outside of his own company.
(f) He should be able to instill a spirit of co-operation in his department.
(g) He should favor the development of understudies.

How It Started

The story of the foremen's development course in the Harvester company is really a study of the development of a desire in the minds of many of the foremen for instruction along certain lines. I do not believe that this desire was created by the management, but rather originated with the foremen themselves through a long period of individual consideration.

Early in 1919 we received letters from foremen and assistant foremen, in which they suggested that some form of training or education for foremen was most desirable. These letters were really written without any constructive program in view, but they suggested the need and indicated a fine spirit of loyalty to the company and further showed a genuine desire for instruction which would make them of more service to the company.

About this time there was evidenced a desire to hold a general mass meeting of all the foremen in all the plants in Chicago. We have eight plants in Chicago, employing in the neighborhood of 1000 foremen, assistant foremen and gang bosses. This meeting was to be in the nature of a get-together meeting for the interchange of ideas and good fellowship.

Welcoming these ideas, the company's officials asked the superintendent in each of the Chicago plants to choose one foreman who they thought would be representative of the entire group at that particular plant, to be a member of the foremen's committee which would meet in the general offices of the company and plan for a mass meeting of foremen, to be held where and when this committee might choose. This committee met in the downtown office several times during the next 60 days. In its general discussion the question came up of securing for the foremen an opportunity for development and the committee decided that this should be considered at the mass meeting of foremen, and presented to the management for approval. The committee then prepared a petition which was O.K.'d by all the foremen in the Chicago plants, for a course of instruction for foremen, the character of which was to be decided at a later date. The management indicated its willingness to co-operate; instead of going ahead as it might have done by preparing a course and presenting it to the foremen, it passed the general problem back to the committee, saying that it would prefer that the foremen themselves tell the management just what they wanted in the way of a foremen's development course, and that insofar as it was possible, the company would help them out.

The committee which had been chosen by the superintendents acted temporarily and held several meetings in making up a tentative program for the course. It realized, however, that

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From a paper presented at a meeting of the American Foundrymen's association held in Columbus, O., Oct. 4-8. The author, M. C. Evans, is connected with the International Harvester Co., Chicago.

it was really not a representative group since it had been picked by the management, and the suggestion came up that an election should be held at each of the plants and the foremen choose their representatives by secret ballot. This was done. In every factory in Chicago a secret ballot was taken, one committeeman being elected for every 25 foremen in that factory (including assistant foremen and gang bosses). Each factory committee elected a chairman and these eight chairmen from the eight shops formed a new and representative committee, which was known as the general foremen's committee, and which would formulate plans for the course.

It was discovered at once that there would be a great deal of secretarial work connected with the enterprise and that few of these eight members had much time to give to the work, so they requested the management to appoint a local secretary at each plant, who could be spared from his regular work at least part of his time to assist them. The management readily agreed and the secretaries were chosen by the local superintendents. In all but one or two cases these secretaries came from the foremen's group. The committee of eight voted to make these secretaries regular voting members of the committee stating that their reason for so doing was that the secretaries were actively employed in working out the plan and, consequently, were better informed at times than the regularly elected members. This, then, made a representative committee of 16, known as the general foremen's committee.

The management appointed a member of the industrial relations department to represent it before this committee with the title of secretary to the general foremen's committee of the foremen's development course. The secretary was not given a vote in the committee, but was to act simply as an advisor, and inform the committee at any time just what the management was able or not able to do for the foremen's development group, also to present requests from the committee to the management.

Committee Met Monthly

In the plans worked out by the committee of 16, it was arranged that the committee should meet once each month in the general offices of the company with the general secretary acting as chairman of the meeting. When the plan was completed, it was taken to the respective plants and presented to each entire group of foremen in these factories. Some minor changes were suggested by the various groups, and as many of these suggestions as seemed practicable were put into the general plan. This plan, with a general program of the course, was then distributed to all foremen.

Up to this time the plans had been only for the Chicago plants, but some of the foremen at the Milwaukee plant who had their ears to the ground got in touch with the movement, and expressed their desire to join in. The same plan was then presented to the Milwaukee group of foremen and accepted as offered. The general subject list covered in the course is here presented in full:

(*A*) *Economics of Business*

1. History of the International Harvester Co.
2. Products of the company.
3. Organization of the company.
4. Economics of Harvester business.
5. The world today.

(*B*) *Shop Practice*

1. Department records.
2. Setting piece work rates.
3. Reduction of costs through the elimination of spoiled work.
4. Maximum production.
5. How to meet manufacturing programs.
6. The planning department.
7. Manufacturing costs.
8. Scientific management in the factory.
9. Electricity in the shop.
10. Metallurgy.
11. Shop machine and material control.

(*C*) *Industrial Relations*

1. The right man on the right job.
   (a) Job specification and job analysis.
2. Safety, accident prevention and health.
3. History of labor unions and their aims.
4. Wage systems.
5. The development of sound industrial relations.
6. Leadership, and the application of the council plan.
7. The industrial relations department and production.

(*D*) *Popular Subjects*

1. Travelogue.
2. The history of a ball of twine.
3. To be arranged.

(*E*) *Summary of the Course*

1. To be given at the banquet at the close of the course.

Not all of these subjects were actually given in the course. The committee decided to omit the following:

1. Electricity in the shop.
2. Metallurgy.
3. Safety, accident prevention and health.
4. Wage systems.

In their place other subjects were chosen which the committee believed would be of more value to the whole group.

The general plan of the course was as follows: Foremen, assistant foremen and gang bosses were eligible for membership in the classes; neither membership nor attendance was compulsory, but a record of attendance was kept. The method of presenting the subjects was to have a carefully prepared lecture about three-quarters of an hour in length, followed by an open discussion, in which any question in the minds of the foremen could be presented to the speaker.

Lectures Were Published

The size of the classes varied, the smallest having about 30 men, and the largest over 200 men. All the foremen in the smaller plants met in one group while in our larger factories it was necessary to divide the group into two sections. At the McCormick works, for instance, there were two classes of 200 men each.

An outline of each talk was published and given out two weeks in advance of the lecture. This gave the men an opportunity to do some reading on the subject and prepare questions beforehand. In some cases, especially at the beginning of the course, the local plant secretary requested three or four foremen to prepare discussions. This was necessary at first in order to overcome a certain amount of diffidence on the part of the men. In later meetings we had no trouble of this kind and it was not necessary to prepare discussions ahead of time.

As a usual thing, the local plant secretary presided at the meetings. He could, however, if he thought best, appoint some other person for that duty. The meetings were held on company time in most cases. We had one or two instances, however, where the local foremen's committee voted to hold the meetings on their own time, and it is interesting to note that when these lectures were given the attendance was as good or better than when on company time. It is thought that some of the foremen felt that their work could not safely be left during regular working hours.

One lecture was given to each class each week until the course was completed, except for a two weeks' vacation during the "flu" epidemic. Enrollment at the close of the course was practically 100 per cent of all eligible. Attendance was good in all the classes and to give some idea of just how good, the writer has taken the liberty of listing the plants taking the course with the average per cent attending classes:

	Per cent
McCormick works	90
Wisconsin steel works	90
McCormick twine mill	75
West Pullman works	75

Milwaukee works	85
Tractor works	70
Deering twine mill	98
Weber works	82

The enrollment grew from 900 to 1100. Approximately 33 1/3 per cent of the whole number of foremen took part in discussion. In some of the smaller plants this percentage ran as high as 85 per cent.

Closed With a Banquet

There was no examination at the close of the course, but a general get-together session was held at the Hotel LaSalle to which all members of the foremen's development course and all the management of the company were invited. Over 1100 men were present. An afternoon and evening session was held. In the afternoon General Manager and Vice President Alex Legge spoke on the Harvester organization, and Harry A. Wheeler, vice president of the Union Trust Co., spoke on the present industrial situation. This was followed by a business meeting and a report by the general secretary. There was then a banquet and an evening session with more speakers. Harold McCormick, president of the Harvester company, acted as toastmaster at the evening session. The entire body of foremen united in a request that the foremen's development course be repeated next year, and the management signified its willingness to go ahead.

Once the general plan was formulated, the foremen's committee was called upon to select men to present the various subjects. Really, the task of presenting one of these subjects was no light matter when it is realized that there were eight factories and in five of these groups a sufficient number of foremen to require breaking them up into two classes. This meant that any lecturer chosen by the committee must be prepared to deliver his talk 13 times. It meant, too, that the speaker should remain to listen and enter into a discussion which lasted anywhere from 15 minutes to three hours, depending on the interest of the men in the class.

The first man that the committee approached was Cyrus McCormick Jr., who was asked to prepare one of the lectures. The writer is pleased to say that he didn't hesitate one moment, but answered "Yes, I'll do it." He looked upon it as a real privilege. It developed that the men selected by the foremen's committee were in almost every case high officials of the International Harvester Co.—only a very few were selected from outside the ranks of the organization—and I believe the officials appreciated this, since it gave them an opportunity to sell themselves and their ideals to the foremen as they had never had before.

We kept *verbatim* minutes of all the discussions, which was no small task. It kept three stenographers busy for many weeks but we feel that it was a profitable investment, for we now have a great mass of material stowed away for future reference.

It may seem strange that the men representing the general foremen's committee, having absolute freedom of choice should have turned to the management for so large a number of lectures. But was this so, after all? It was to be an efficiency course in one sense, or a course that was to help every foreman fit himself for his job. That job was within the walls of our plants; in other words, he was to be an executive in that plant. And, who could better aid him in this than the men who had climbed that same ladder?

Harold F. McCormick, president, has actually spent time in the shops, assembling binders and mowers; he then went into the sales department and became a blockman and then a branch manager, and then came into the general office as treasurer, then vice president and finally president. Alex Legge, vice president and general manager, started in the Harvester company in the sales department and as a collector. Mr. Perkins, vice president in charge of manufacturing, started as a clerk in the foundry, and Mr. Utley, vice president in charge of raw materials, also began in the shops. Mr. McKinstry, in charge of sales, was a shop man. He became superintendent of the Hamilton works, then division manager, and now is a vice president. Mr. Ramsey, now secretary and treasurer, began as assistant cashier.

Woman Lectures

The writer could go on through the entire list, including superintendents and works managers and other men of the management, and it is practically the story in every case that these men have come up through the ranks. The foremen are wise enough to know that they could benefit from the experience of these higher officials.

One of the lectures of this course was given by a foreman, and three were given by outside persons, one of them a woman. Some of us had doubts about this woman's part in the work, because she had a theme that must be handled deftly. She was an elderly woman who had had a world of experience. She put her lecture across so well that one of our factory superintendents, who had been among the skeptics in regard to her subject, told her at the end of the lecture that any time she wished to deliver that lecture to all his men, he would blow the whistle, shut down the works, and assemble the men for that purpose.

Visit Other Plants

In addition to the regular classroom work of the course the committee suggested, in order that the foremen in one plant might have the privilege of studying the work of foremen in another plant in departments similar to their own, that a special visiting schedule be arranged whereby all the foremen in Chicago works would have the privilege of visiting the other plants. It was thought by this committee that many of these foremen had worked out special methods in their departments which would be of advantage to other plants. Accordingly, such a plan was worked out, and among other things it was required that the person making the visit should write a complete report of his findings, criticising the methods in his own and the plant he visited, also making any suggestions, if he could, for better ways of doing work in his own and the other plant.

I really believe this visiting program was the most successful part of the whole foremen's development course. In visiting the different plants and in talking with the foremen in their own departments, they always had a good word to say for the privilege of visiting the other foremen in the different plants. All of the reports which these foremen made out were sent to the general secretary of the foremen's development course, where they were duplicated and copies sent to the officials of the company interested in the particular points mentioned in the report. The visiting program worked out far beyond any success that we had dared hope to achieve.

Soon after the course was started we found that there was a desire on the part of the foremen for references on the various subjects which were presented to them. Accordingly, a library system was started with a main library located at the general offices of the company, acting as a general clearing house for books. The books were carefully chosen with reference to the foremen's course and the foremen were supplied with a fortnightly review of all books and periodicals which had any bearing upon their work. They could obtain any of these books or periodicals by simply sending in a small card indi-

cating the particular book desired.

The following incident illustrates how the foremen accepted and took action upon a suggestion made by one of the speakers. After A. H. Young, manager of industrial relations for the International Harvester Co. had finished his talk before the foreman of the West Pullman works and after several of the men present had expressed their views, Mr. Harrison, the superintendent took the floor. He proposed to try out one of the speaker's theories at once.

"We have here," he said, "something that is material. I get a daily report from the employment manager of whom he hires. Next week I am going to ask the employment manager to give me his employment sheet, and on that will be indicated the number of men hired. Some departments will have none, and some will have quite a number, and I am going to ask each one of the foremen who hired any men to get up on the floor and relate his experience—what the man did, how he acted, what he said when the foreman took him back and introduced him to at least three men. I want you to tell whether he laughed and thought you were crazy, or whether he looked serious and seemed to appreciate it. The employment manager is to take care of his part. He is to show the man the store room, the time department, the doctor's office, etc., and he is to tell him about pay day; after that it is up to you."

They did try it out and did succeed—so well, in fact, that some of the other plants adopted the method immediately. This is only one of the definite results. There are many others that might be mentioned, and there are a large number of which I know nothing.

We found after the course had been in operation for some time that there was need of some method of follow-up. To do this we made use of a weekly news letter edited by the general secretary of the course. This news letter made a summary of the discussions at the various plants on any particular subject, making it possible for foremen in one plant to know what the discussions had been in the other plants, and in this way all were benefited. The news letters, as well as the outlines for the lectures, were all printed and a copy sent to every member of the course.

It is interesting to note at this point what one of the foremen thought the purpose of the course was. He expressed it so well that the statement is repeated in full. "The purpose of this course," he said, "is to make it possible for the foremen to share in the management and the responsibility of this company, thus improving the company's administration, and to secure greater co-operation with his fellow workers, and in addition to help solve some of the particular problems which arise in his work, and to increase the quality and quantity of the production of every man in the shop by securing better co-operation between the foreman and his workmen."

This, in my opinion, is the thought of every member of the foremen's committee.

Almost every day we are receiving calls from the foremen asking about the plans for this coming year and when the committees will begin to meet again. The fact is that committees are already holding meetings in their local plants, and some good suggestions have been made for the course to be given this year.

The plans for this year's course are not complete enough to be discussed in detail, but it seems that there is a desire on the part of the men for a course somewhat similar to the one given last year, only that we should cover more specific subjects and not have so many general subjects discussed as last year.

There is no question in my mind but that the foremen's development course has been a success and that it has really paid in dollars and cents as well as in many other ways which cannot be figured in terms of money.

I should recommend to those contemplating a training course for foremen that they invite the foremen in to get their reactions and, better than that, that they ask the foremen to take charge of the course and run it themselves. They can do it. At least it has been so proven to our satisfaction.

Electric Furnace Has Proved Value

(*Concluded from Page 997*)

The absence of overhanging cables and water connections makes practical the quick replacement of one furnace shell with another one of the same size. The entire operation will not require over 30 minutes, nor is it necessary to cool down the furnace. Melting time can be saved if the new shell has previously been heated to temperature by the use of an oil flame. This ability to change shells is especially advantageous when great flexibility in melting operation is important. Special switching arrangements and transformer connections can be provided to take care of change in power input if required. There is the further advantage that by making use of a number of different shells with only one furnace base, transformer, and electrical equipment, entirely different metals and mixtures can be melted without contamination of metal. As a result, extra furnace shells can be used not only to provide better conditions for melting all kinds of materials to meet special conditions, but also, in the case of installations of a large number of furnaces in one plant, it would be good economy to have an extra shell on hand, completely lined, ready for instant use.

Melt Borings in Cupola

Question:—We produce quite a quantity of borings and chips in our machine shop and have been wondering if there is not some way in which they could be melted in the cupola. At the present high price of pig iron we feel that it is necessary to conserve our resources as much as possible. We remember reading in THE FOUNDRY some years ago of a method of utilizing cast iron borings but at that time we were not interested. At present the information is not available and we should appreciate it if you would advise us as to what is the best method for doing this work.

Answer: The best method, in our opinion, for charging cast iron boring in a cupola is to pack them in lengths of stove pipe and introduce one or more in each charge containers. Several methods are available for sealing the ends of the pipes and the job can be done in the machine shop or on the charging platform.

In one installation, a number of stove pipe links are kept near each machine and as the chips accumulate they are dumped into them. They are gathered up by one of the furnace laborers every day and taken up to the stage. Several methods will probably occur to you for crimping the ends of the pipes. In the shop referred to one end of the pipe is flattened out and about an inch turned over. When a sufficient amount of borings is loaded into the container the top end is knocked together in a straight line and also folded over in the same manner.

In some places, small wooden boxes, about 6 x 8 x 12 inches are used. When they are filled a cover is nailed on. Either method is satisfactory.

The average amount of air for the complete combustion of fuel oil is about 14 pounds of air to 1 pound of oil, or 183 cubic feet of air at 60 degrees Fahr.

Correcting Flaws in Metals and Mixes

Problems of the Gray-iron, Malleable and Steel Foundry Discussed

By H. E. Diller

Two Methods Used to Anneal Gray Iron

Question—We want to know how to anneal gray-iron castings—that is, the time and temperature required and any thing else we should know to perform the operation successfully.

Answer—There are two methods of annealing gray-iron castings. In the one, the iron is heated to 550 degrees Cent. for several hours, depending upon the thickness of the casting. It is then allowed to cool slowly. This process is for the purpose of relieving internal strains in the iron. It is often carried on after the casting has been partly machined. Gas engine cylinder castings and similar castings are treated in this manner. When they are annealed before the outside skin is taken off the casting, they are likely to be slightly out of round when machined. For this reason some foundries take the first cut before annealing the castings. In such cases the castings should be placed in cast-iron or steel annealing boxes and a small amount of carbon in the form of coke dust, or charcoal should be added. The box should then be covered and all cracks luted with fireclay. The carbon produces a reducing atmosphere and prevents the castings from becoming oxidized.

Another purpose of annealing castings is to soften them and remove the effects of chills which are sometimes produced in very light sections. To accomplish this purpose it is necessary to heat the castings to about 850 degrees Cent. and cool them slowly after holding them at the required temperature for an hour or two. Such treatment will weaken the metal in the casting to some extent.

Small Chilled Wheels Crack in Molds

Question—We are casting a chilled cast-iron truck wheel and a large percentage of the wheels crack. Our cupola charge is made up of 50 per cent ordinary machinery and stove plate scrap, and 50 per cent soft foundry pig iron. The wheels are poured on cast-iron chills and allowed to cool in the sand.

Answer—Although you have made no analysis of your metal it is probable, judging from the class of iron in the mixture, that it contains too much silicon. We would recommend that you use a mixture made up of 50 per cent scrap and 50 per cent pig iron, of such a composition to give a metal with approximately 0.75 per cent silicon and not over 0.300 per cent phosphorus. The manganese should be around 0.60 per cent and the sulphur between 0.07 and 0.140 per cent. Broken car wheels could be used for scrap and the pig iron should be purchased on analysis to give you the composition desired to make metal according to the composition outlined.

It also is essential that these wheels be taken from the mold as soon as the metal is set, and put into soaking pits. This treatment will allow the wheel to cool slowly and so prevent intense strain and cracking.

Rusting Closes Holes in Leaky Castings

Question.—We would like to know how to stop leaks in cored stove barrels that are used for heating water. The leaks are slight, the water sweating through the iron at different spots.

Answer.—There are different methods for preventing water from sweating through thin sections of iron. The difficulty is that the iron is porous. This may be overcome through closing the pores by rusting. This is sometimes accomplished by allowing the castings to stand exposed to the weather for several months. It may be done more rapidly by soaking the castings in a 5 or 10 per cent solution of ammonium chloride and then taking them out of the solution and allowing them to dry. The castings need be kept in the ammonium chloride solution only long enough to allow the liquid to penetrate through the pores, as the rusting takes place while the castings are drying. Another method of stopping leaks is to soak the castings in a dilute solution of water glass, then remove them from the solution, wash the water-glass from the surface and allow the castings to dry.

However, these processes are only makeshifts as the castings should be made so that they do not leak water. To accomplish this they should be poured with low-phosphorus iron. A mixture could be made from malleable pig iron and your own scrap from the mixture, which would not contain more than 0.20 per cent phosphorus.

Hard Iron Star Mixture

Question—We are getting ready to make hard-iron stars for the trade and would like some information about the most economical mixture to use to secure a good grade of stars. Please tell us what kind of pig iron to order and say whether we should use steel scrap.

Answer—Under the general market conditions prevailing at the present time it is difficult to give the most economical mixture to use without studying local conditions. It will be necessary for you to check up quotations on the material which you are able to secure.

We do not think you would be greatly benefited by using steel scrap in the mixture unless you are able to purchase it below the general market price. However, you would be able to use malleable scrap to advantage at the market price. A mixture consisting of 30 per cent pig iron, 35 per cent malleable scrap and 35 per cent sprues and scrap from your own foundry would be desirable. In case of any variation in the amount of sprue or the use of scrap steel the amount should be adjusted by a change in the percentage of malleable scrap. The pig iron in such a mixture should have approximately 2 per cent silicon with phosphorus as low as can be obtained without an extra charge.

In the metal used, silicon should range around 1 per cent; sulphur should not run over 0.20 per cent; phosphorus should be kept as low as possible without an extra charge, as already has been stated; manganese may vary from 0.40 to 0.90 per cent.

Casting Heads on Steel Valve Stems

Question—We wish to make gas engine valves by casting the gray-iron head on a steel stem. Will you kindly advise us how this should be done and the quality of metal to use?

Answer—In order to cast the heads on valve stems either gated patterns or plate patterns are used. The

drag flask has a bar running across it. The stems are placed through this bar and rest in the pattern. By this means the stems are held in their proper place while the drag is rammed. The cope is rammed in the usual way. The castings are gated on the side, that is, at the circumference of the head. The stems which are imbedded in the castings are either threaded with a fairly coarse and deep thread, or else each stem has a hole bored through it in that portion around which the iron is cast. By these methods the iron is enabled to close in around the stem and form a tight joint. It will not fuse to the stem because the body of molten iron is cooled too quickly for this. The stem fitting into the casting must be free from iron oxide and moisture. It should, therefore, be cleaned by grinding if a hole is bored into it; of course, if it is threaded, it will then be free from scale without special cleaning. After it is cleaned, it should be coated with a thin coating of shellac, which will prevent moisture from forming on it. You will note that in the finished valves the cast-iron head tapers off into a feather edge. This is due to machining as this neck must be cast 3/16 to ¼-inch thick in order to prevent chilling and give a metal soft enough for machining.

It is important to get the correct metal in these castings and a mixture made up of 10 to 15 per cent steel, 30 to 40 per cent scrap iron from your own foundry, and the remainder of pig iron should be used. The silicon contents should be such as to give you a comparatively hard metal which must, however, not chill around the stem. By proper melting, a metal with 1.70 to 1.90 per cent silicon will be of the right hardness. It should contain approximately 0.60 per cent combined carbon. The sulphur should be kept below 0.12 per cent and the manganese between 0.60 and 0.90 per cent. Phosphorus around 0.40 per cent will be satisfactory although this may be varied to quite an extent without affecting the quality of the casting.

Dimensions on Drawings Should Be Plain

BY M. E. DUGGAN

HAVE you ever glanced hurriedly over a drawing with the idea of obtaining a general impression so that you could proceed with getting out the stock for the pattern? You receive the impression that a certain dimension is, let us say 9½ inches and prepare your rough stock with that dimension in mind. About the time you are all ready to work it up into the finished piece, you take another look at the drawing and discover to your surprise that the figure is 8½ inches and not 9½ as you had supposed. Even after you have convinced yourself that 8½ is right you find it hard to get the 9½ impression out of your mind. First impressions are lasting. That is the reason for directing attention to the way some draftsmen place their dimension figures and lines on a drawing.

The practice of placing the dimension lines or figures within the drawing as at the right in Fig. 1, is bad. They fill up the space and confuse the workman when he tries to visualize the object. There are instances where it is quite proper and practical to place the dimensions within the drawing in order to make the instructions clear to the workman and thus avoid the making of mistakes in the construction of the pattern or in the machining of the casting.

This point is illustrated by the following case: Four crane wheels of the type shown in Fig. 1, were ordered and made in a hurry and then all four were spoiled in the machine shop. The workman made a mistake in reading the drawing when he started the first wheel and, although he looked perfunctorily at the drawing several times afterward, the first impression remained. When he was shown his mistake he refused to accept the responsibility and said that the blame should be laid on the man who placed the dimension lines on the drawing. This part of the drawing is shown at the left in Fig. 1. The wheels measured 14 inches in diameter. The workman suggested that fewer figures be used and that they be placed on the drawing in such a way that they could be read easily and quickly at the first glance. To illustrate his point he marked the drawing as shown to the right in Fig. 1. Practically any man who has to work from a drawing would prefer to have it dimensioned as shown to the right in preference to the style adopted as shown on the left of Fig. 1. It is practical and is easily, quickly and correctly read by the workman.

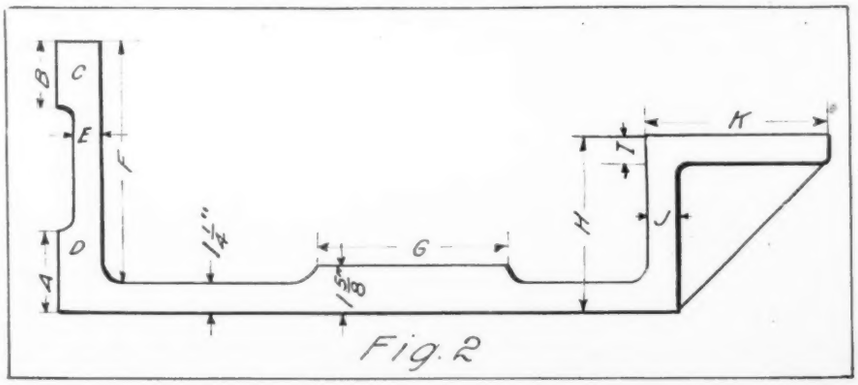


FIG. 2—ONLY TWO DIMENSIONS SHOWN ON THIS VIEW

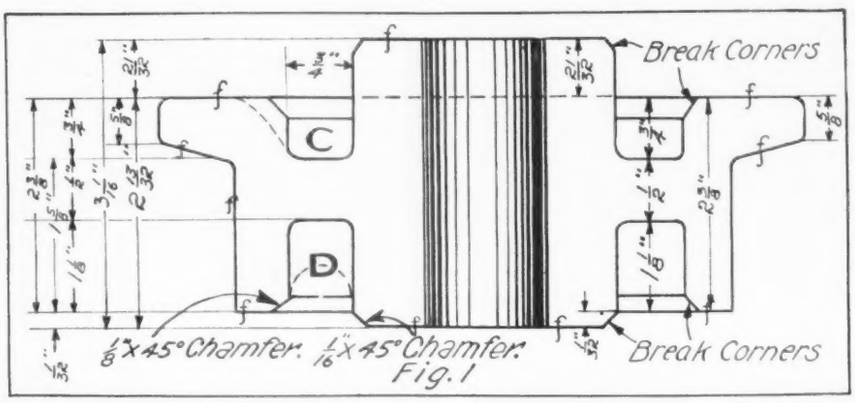


FIG. 1—RIGHT AND WRONG WAY TO SHOW DIMENSIONS

Many mechanics carry reading or magnifying glasses in their tool kits. Drawings which cannot be deciphered without the aid of magnifying glass should not be allowed in a shop, nor should a workman be expected to get his information from them.

Another considerable cause of trouble in the pattern shop and foundry is when the draftsman insists on including details like the grooves shown at *C D*, Fig. 1. In the case of break down jobs particularly where the draftsman is sent to make a sketch for the information of the patternmaker, a great many details which, if included, are only a source of trouble in the pattern shop and foundry, may profitably be omitted. The manufacturer who makes these wheels regularly is equipped to furnish all the details such as chamfered corners and the grooves shown at *C D*, but they are quite unnecessary when making one of those quick repair jobs. If these deep and narrow grooves are molded in green sand they require special care on the part of the molder to prevent them from washing away in the drag, or dropping from the cope. If it is desired to make them in dry sand the patternmaker must attach prints to the pattern, top and bottom, and make core boxes to correspond. Such items add to the labor and delay and are unnecessary. The wheels will answer every requirement if the grooves are made as shown in the dotted lines and the bevel on the hub and rim may be omitted altogether without in any way impairing the usefulness of the wheel. In other words all unnecessary details of design should be omitted from a hurry-up repair job whether the workman gets his instructions from a drawing or from the broken part of the casting itself.

While on the subject of sins of omission and commission on the part of the draftsman another mistake that is made frequently will be mentioned. The illustration, Fig. 2, is taken from the original blue print which showed four views of this particular piece. The view which has been selected contained only the two dimensions, 1¼ and 1⅝ inches. The other necessary dimensions for making the job, *A*, *B*, *C*, etc., were scattered over the other three views. Eleven dimensions were distributed over four views when they might just as well all have been grouped on one as indicated by the letters from *A* to *K*. What kind of a first impression would a man get by consulting this style of a drawing?

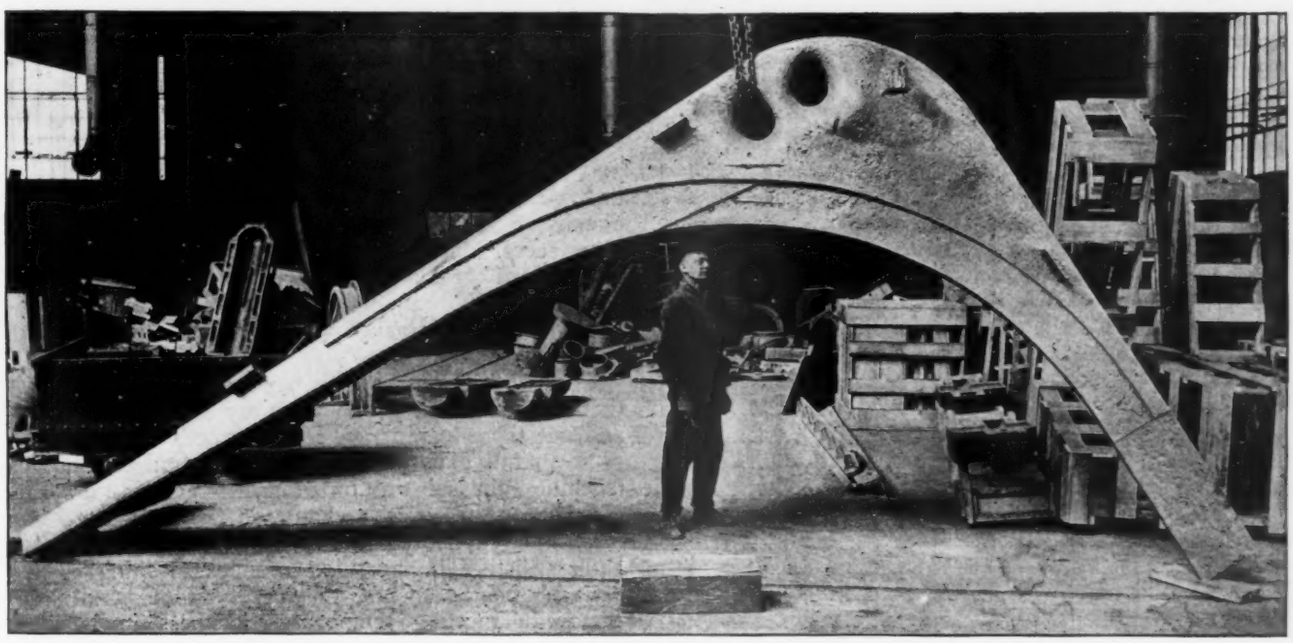
Furnace Charge More Than Twice Rate Capacity

What is believed to be a record has been set by a 3-ton Greaves-Etchells electric furnace installed in the Philadelphia navy yard when a charge of 14,850 pounds of steel was melted down in one heat. The greater part of the metal was poured into a mold to form a stem piece for the U. S. S. DOBBIN, shown in the accompanying illustration. The cleaned casting weighed 7450 pounds. The remainder of the steel was utilized for pouring the other work on the floor.

It is stated that the power consumption for this exceptionally large heat was only 801 kilowatt-hours per ton. The engineering officer in charge of the foundry reported that the casting was of good quality and showed the following chemical analysis: Carbon, 0.38 per cent; manganese, 0.89 per cent; phosphorus, 0.008 per cent; sulphur, 0.022 per cent; silicon, 0.33 per cent; nickel, 0.69 per cent. Two test specimens attached to this casting showed yield point, 58,000 pounds per square inch; tensile strength, 89,500 pounds per square inch; elongation in 2 inches, 25 per cent, and yield point 55,250 pounds; tensile strength, 89,000 pounds and elongation 25 per cent.

A full pattern was employed to make the mold. It was bedded in the foundry floor and covered with several copes. After the mold was finished a number of iron blocks were laid on the joint and the cope set over the drag. A low-pressure oil burner was introduced at the end of the mold to dry it, and the space around the joint between the cope and drag was closed with loose bricks. Two days were required to dry the mold.

The value of the primary aluminum produced in the United States in 1919, according to reports received by the United States geological survey, department of the interior, was $38,558,000, as compared with $41,159,000 in 1918. This decrease of $2,601,000 was probably due to a curtailment of production in 1919, forced by the accumulation of large stocks of aluminum by both the government and the manufacturers in 1918. The market prices quoted during the first four months of the year were lower than those which prevailed during the remaining months, and apparently most if not all of the stocks were taken by the beginning of the last quarter. The figures for this year are not yet available.



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THE FOUNDRY

Registered U. S. Patent Office

A semimonthly journal devoted to all branches of the foundry trade

Published by
THE PENTON PUBLISHING CO., CLEVELAND

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SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....$5.00 a year
Single Copies.....25 cents

Copies published three months or more previous to date of current issue, 50 cents each

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 1st and 15th of the month preceding date of publication.

Member, the Audit Bureau of Circulation and Associated Business Papers Incorporated

Entered at the Post Office at Cleveland as Second Class Matter

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Now is the Time For Readjustment

FEVERISH activity which has characterized the foundry industry for over a year apparently has come to an end. Some few look upon the present conditions as extremely grave and see nothing ahead but a period of complete stagnation. Pinned down to actual brass tacks they can produce little to support their gloomy forebodings; but owing to a peculiar temperament which makes some view everything through jaundiced eyes, a temporary drop in the business barometer convinces them that the ship of business is headed for the rocks.

To those who are disposed to view business in a normal manner, the present slack period is only a breathing spell and is welcomed as such inasmuch as it affords an opportunity to check up on past performances, to sift and analyze methods and processes, and, with the proper perspective which time alone can give, to review the activities of the past months.

While necessity has introduced methods of increasing production, the results have been successful to only a limited degree. Inventions of a real worth are evolved only under the spur of necessity superinduced by healthy competition. Competition is a word that practically has gone out of use in the foundry. New shops have been built. Additions have been added onto others to try and take care of the rising tide of orders which began to flow in 1914 and with only a temporary slack was at full flood in 1919 and 1920 and is now at the ebb.

Competition unknown to the manufacturer has been found among the consumers. Instead of snatching work away from one another, frequently at prices which did not cover the cost of production it has been nothing uncommon for large foundries to farm out work which they could not resist the temptation to take on although they knew their plants already were taxed beyond their capacity.

With decreasing volume of orders it is natural to anticipate that foundrymen once more will find themselves bidding against each other for work enough to keep their plants in operation. In many instances it will be found that conditions, methods and equipment that were considered adequate under abnormal and forced conditions will no longer produce dividends.

The Scotch who, usually are regarded as standard authorities on thrift, have a saying that "Many mickles make a muckle" and it may be that many foundrymen could study that saying with profit during the present readjustment.

It was inevitable during these recent pressing years that innumerable ideas have occurred to men immediately in touch with the foundry industry. These ideas were connected with easier, quicker and better methods of production. Under the insistent demand for quantity at any price many of these ideas have either been side-tracked or allowed to pass without action.

Under conditions as they now exist, it would appear that the present is the time to try out all these ideas and put them in practice. It may be a rearrangement of the relative position of the floors and the molding machines, the substitution of green sand for dry sand in some of the cores, a change in the manner of handling the cupola charges or any one of an almost endless list. The adoption of ideas leading to economical operation not only will prove a desirable factor in meeting temporary slackness in business; but will be an added advantage in a few months when it is hoped business once more will be normal.

Trade Outlook in the Foundry Industry

NO MORE encouraging sign can be found in the present industrial and business situation than the steady and rapid drop in prices in all lines. Even those who at present are severely affected agree that the thorough reaction which is under way will lead to a quicker recovery. Cessation of buying which started in the late summer and early fall quickly brought about a tendency to lower prices in finished materials. This did not serve to retard the slump in buying, and further price recession has been noted in many lines. The immediate effect upon unfinished products under which heading castings appear, was noted in diminished orders, followed by requests for deferred deliveries and cancellations.

Low Ebb Approached

Price reductions which were inaugurated in finished commodities were slow to be adopted by producers of raw and semifinished material. However, marked recession in most raw materials now is evident and probably will continue. The entire cycle of depression has been brought about through a sudden stoppage of the outlet for manufactured articles. The public ceased to buy. Falling prices up to the present have had no effect upon this general disinclination to exchange money for goods. With the slacking off in industrial activity unemployment, lower wages, and the lower prices for agricultural produce, some measure of the public's buying power has been curtailed. Therefore, the drop probably will continue until a balance is reached when the new price level will be firmly established, and when the latent demand for goods again asserts itself. No doubt exists that war time restrictions prevented an adequate supply of manufactured goods, and a demand accumulated which was not entirely satisfied in the months of great activity which followed the armistice. Today, when practically no buying is noted, the demand is still further strengthened. Therefore, when a firm price level is reached, a period of exceptional activity should result. Foundries will be among the first to benefit from the business revival. Railway equipment will be needed as soon as freight movement again brings a burden upon roads which have not been able to maintain their lines as they should have in the past three years. The automotive industries again will be large users of castings, although probably not to the degree noted in the past year. Tractors and trucks probably will be as actively in demand during the coming year as in 1920, as a steady and normal increase in these branches of the industry has been noted since 1916. Housing construction work and the erection of buildings and the extension of public service properties doubtless will be greater in the months to come than during the past year. High prices and high wages have restricted building activities and the difficulty of financing municipal or public service extensions have held back much needed work. Easier credit conditions and better markets for improvement bonds already give promise of the resumption of much public work which will result in a step toward normal activities in other lines.

Prices of Raw Materials for Foundry Use

CORRECTED TO DEC. 7

Iron		Scrap	
No. 2 Foundry, Valley	$37.50	Heavy melting steel, Valley	$21.00 to 22.00
No. 2 Southern, Birmingham	36.00 to 38.00	Heavy melting steel, Pittsburgh	19.00 to 20.00
No. 2 Foundry, Chicago	38.00	Heavy melting steel, Chicago	16.50 to 17.00
No. 2 Foundry, Philadelphia	42.00 to 43.50	Stove plate, Chicago	25.00 to 25.50
Basic, Valley	33.00	No. 1 cast, Chicago	21.50 to 22.00
Malleable, Chicago	39.50	No. 1 cast, Philadelphia	31.00 to 32.00
Malleable, Buffalo	41.00 to 43.00	No. 1 cast, Birmingham	26.00 to 28.00
		Car wheels, iron, Pittsburgh	30.00 to 31.00
Cooke		Car wheels, iron, Chicago	27.50 to 28.00
Connellsville foundry coke	$8.50	Railroad malleable, Chicago	17.50 to 18.00
Wise county foundry coke	12.00	Agricultural malleable, Chicago	17.50 to 18.00

Output Restricted

Pig iron production during November showed strongly the effect of the general depression. The total output was 2,929,576 tons, as compared with 3,288,341 tons for October, according to figures compiled by *The Iron Trade Review*. While this is a reduction of only 8 per cent in tonnage, the number of stacks which went out of blast gives a more correct basis of comparison and foretells still lower production for December. The number of furnaces in blast on Nov. 30 was only 256, a loss of 34 over the 290 stacks given in October. This is the lowest figure noted in 12 months. Four merchant stacks were blown in during November and 21 were blown out, giving a net loss in this class of 17. Loss in production wa more pronounced in merchant iron during the past month than in the steel grades. The November output was 702,888 tons as compared with 818,166 tons for October, a loss of 115,278 tons or over 14 per cent. The average daily production in November was 23,430 tons, which compared with the October figure of 26,392 tons shows a decrease of slightly over 11 per cent. Slack demand for iron has brought price recessions in all districts. The reduction in furnace activity has had a marked effect upon the coke market as a surplus has been created, resulting in lower prices and a reduction in coke oven operation. Furnace coke has been sold as low as $7 a ton in the Connellsville region and $6 a ton has been offered. The falling demand has brought price reductions, has created a surplus, and just at present is forcing some marked reductions in output in foundry coke as well.

Malleable Slows Down

Malleable shops up to the present time have been less strongly affected by the slump than have the gray iron and steel foundries. Operations for November probably will be slightly below the figure given for October, and at present many are working entirely upon back orders. Makers of malleable chain have been particularly fortunate in having a backlog which will occupy their facilities for another 90 days. Nonferrous metal prices based on New York quotations for Nov. 8 follow: Casting copper, 13.50c; lead, 5.00c; Straits tin, 35.25c; antimony, 5.75c; aluminum, No. 12 alloy, producer's price, 32.00c, and open market, 23.50c. Zinc is quoted at 6.25c to 6.35c, East St. Louis.

Comings and Goings of Foundrymen

ROBERT SNOW, for many years connected with the Detroit Foundry Co., Detroit, Mich., and more recently superintendent of the Great Lakes Foundry Co., Port Huron, Mich., has been appointed general superintendent of the Zenith Foundry Co., Detroit, Mich. which is now building a large modern foundry that will specialize in light jobbing castings.

Frank O. Metz has been made production manager of the York Mfg. Co., York, Pa., and H. L. Zimmerman has succeeded F. L. Rockey as general foreman.

John J. Hutmacher, who was superintendent of the Thomas Davidson Mfg. Co., Montreal, Canada, has been made superintendent of the Converse Foundries Co., Alliance, O.

Phillips Isham recently has been appointed the eastern selling agent for the Pittsburgh Metallurgical Co., Niagara Falls, N. Y., producer of bessemer ferrosilicon and silvery iron.

W. W. Wetzler became connected with the Gerlinger Electric Steel Castings Co., West Allis, Wis., and will have charge of its credit department, 14 East Jackson boulevard, Chicago.

John C. Pangborn, vice president, Pangborn Corp., Hagerstown, Md., manufacturer of sand-blast and allied equipment has left for Europe on a several months' business trip.

T. O. Parey who is building a manufacturing establishment at Connersville, Indiana, soon will be in the market for machine tool and iron and brass foundry equipment and supplies.

Stanley R. Costley, for the past 15 years with the J. S. McCormick Co., Pittsburgh, has severed his connection with that company and will be associated with the Cary & Costley Foundry Supply Co., with offices in the Fulton building, Pittsburgh.

August Lantschoot has been placed in charge of the chemical and metallurgical laboratory recently inaugurated by the Iowa Malleble Iron Co., Fairfield, Iowa. Mr. Lantschoot received his metallurgical training in the laboratory of Enrique Touceda, Albany, N. Y.

Charles H. Cochran has discontinued the Perrysville Stove Works, Perrysville, Ind., and has oganized the Crawfordsville Foundry Co., Crawfordsville, Ind. All machinery and equipment has been moved to Crawfordsville and the foundry is now in operation on jobbing work.

John Arthur Durr, who until recently was metallurgist for the Saginaw Malleable Iron Co., division of the General Motors Corp., Saginaw, Mich., has accepted the position of metallurgist and efficiency engineer for the two plants of the United States Malleable Iron Co., at Wauseon and Toledo, O.

Rogette D. Earle, for the past 11 years superintendent of the foundry of the Belcher & Taylor Agricultural Tool Co., Chicopee Falls, Mass., a division of Bateman & Cos., Inc., has severed his connection with the company after being with it 33 years. John W. Williams will probably succeed him.

Donald S. Barrows, until recently works manager and chief engineer of the T. H. Symington Co., manufacturer of railway specialties, Rochester, N. Y., has been vice president in charge of operations of that company. Mr. Barrows became connected with the Symington company as chief engineer in 1915 and was made works manager in 1917.

Roy N. McCombs who until recently was foundry foreman for the Climax Engine Co., Clinton, Iowa, has been made foundry foreman for the Swift Mfg. Co., Waterloo, Iowa.

Fred Rogers, foundry superintendent of Green Fuel Economizer Co., Beacon, N. Y., has resigned to accept position as foundry superintendent with the Berks Foundry & Mfg. Co., Hamburg. Pa.

Helmus B. Wells, secretary of the Northwestern Malleable Iron Co., Milwaukee, and a number of associates have purchased the entire interests of the Oliver Mfg. Co. of Chicago, maker of automobile jacks and tools. The plant and offices will be moved to Milwaukee and Mr. Wells will assume the active management and be president of a Wisconsin corporation of the same name which has been organized to take over the Chicago company. Mr. Wells was secretary of the Northwestern Malleable Iron Co. 16 years and will retain an interest.

O. E. Falls, who has had many years of experience in charge of foundry welding work at the Norfolk navy yard, Portsmouth, Va., has accepted a position with the Metal & Thermit Corp., New York. Mr. Falls obtained his earlier foundry experience from positions held at the Norfolk & Western Railway shops, Roanoke, Va., the Richmond Locomotive Works, Richmond, Va., Pennsylvania Engineering Works, New Castle, Pa., the Franklin Air Compressor Works, Franklin, Pa. the Seaboard Air Line Railway Co. shops, Portsmouth, Va. In 1905 he joined the Goldschmidt Thermit Co., and in 1907 returned to the Norfolk navy yard and for 10 years supervised the welding work including repairs made on battleships, torpedo boats and torpedo boat destroyers. After leaving the Norfolk navy yard in 1917 Mr. Falls became superintendent in the steel foundry of the Bay View Foundry Co., Sandusky, O. He was later appointed superintendent of the steel foundry of the Weatherley Steel Castings Co., Weatherley, Pa., and still later superintendent of the Iron & Brass Foundry of the Gaskins Foundry Co., New Bern, N. C. He was superintendent of the Iron & Brass Foundry of the Manning Mfg. Co., Rutland, Vt., when he accepted his present position with the Metal & Thermit Corp.

DURING preceding years it has been customary to bind the annual index to THE FOUNDRY *in the last issue each year. With the inauguration of semimonthly publication, the index has grown to such proportions that it is impractical to bind it with the magazine and therefore, it is omitted from the current number. The complete listing of all articles published during* 1920 *with cross references and an authors' index has been prepared and will be ready for distribution within a short time. This will be sent free upon request to any subscriber who requests his copy through the Circulation Department,* THE FOUNDRY, *Cleveland.*

Valve Regulates Volume of Liquid Fuel

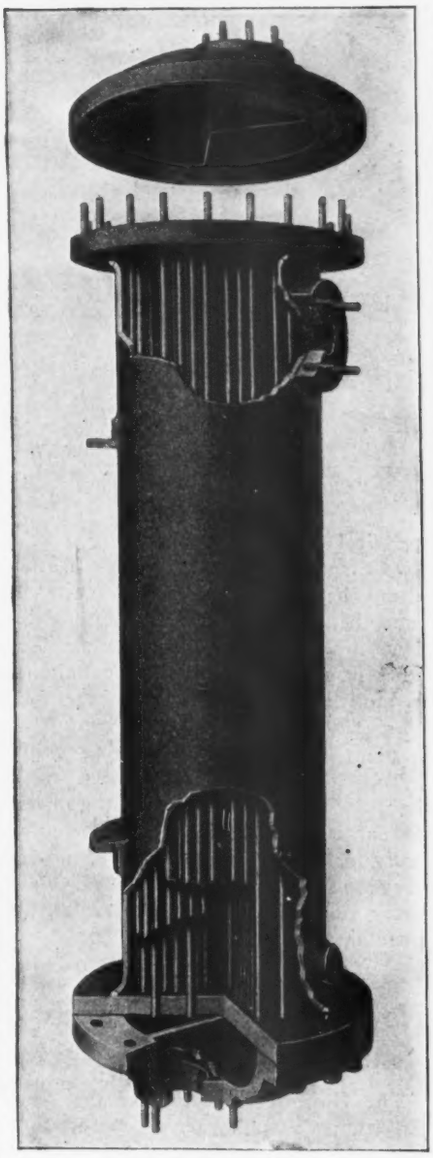
The valve shown in the accompanying illustrations, designed to regulate the flow of liquid fuel has been patented by A. V. Rigby and is now placed on the market by Bailey-Lewis, Inc., Pittsburgh. It was installed and tried out first at Farrell

Works of the Carnegie Steel Co., where it is claimed it has given complete satisfaction for the past two years.

The vital feature of the valve is the triangular aperture in the valve seat beveled back from the face and the sliding, shearing valve running in a groove cut in the face of the seat. A cross section of the assembled valve is shown in Fig. 1. A top view of the valve seat and triangular opening is shown in Fig. 2. Fig. 3 is shown to illustrate the appearance of a sectional view through the valve seat (20), the triangular opening (21) and the valve (4). From these it will be apparent the manner in which the valve slides across the triangular opening 1 inch long by ⅛ of an inch at its greatest width. This movement regulates the flow of fuel by opening and closing the aperture.

The distinctive features of the valve and the manner in which it operates are clearly shown in the sectional view Fig. 1. The fuel enters through the opening (12) and passes down through the stop-cock (3) into the trap (8) where any sediment or particles of heavy fuel settle. The fuel then passes through the triangular opening in the valve seat to the nozzle or burner. If sediment should lodge in the opening in the seat it can be cleared off by turning the handle of the valve (7). The stem of the valve is threaded so that one complete turn of the handle moves the valve ⅛ of an inch. This operation shears off the particle of sediment and allows it to fall into the trap. The trap can be cleaned in a few minutes without stopping the flow of fuel through the valves by turning the stop-cock (3) and removing the block (9).

The lock nut arrangement makes it possible to set the valve for any required quantity of fuel necessary. The valve is manufactured in two standard sizes: one has a 1-inch travel and the other ½-inch. Special sizes can be built to specifications. It is claimed that a saving of from 5 to 15 per cent is effected where this valve has been employed to regulate the flow of fuel in open hearth furnaces; heating furnaces; under boilers and in other installations where liquid fuel is used.



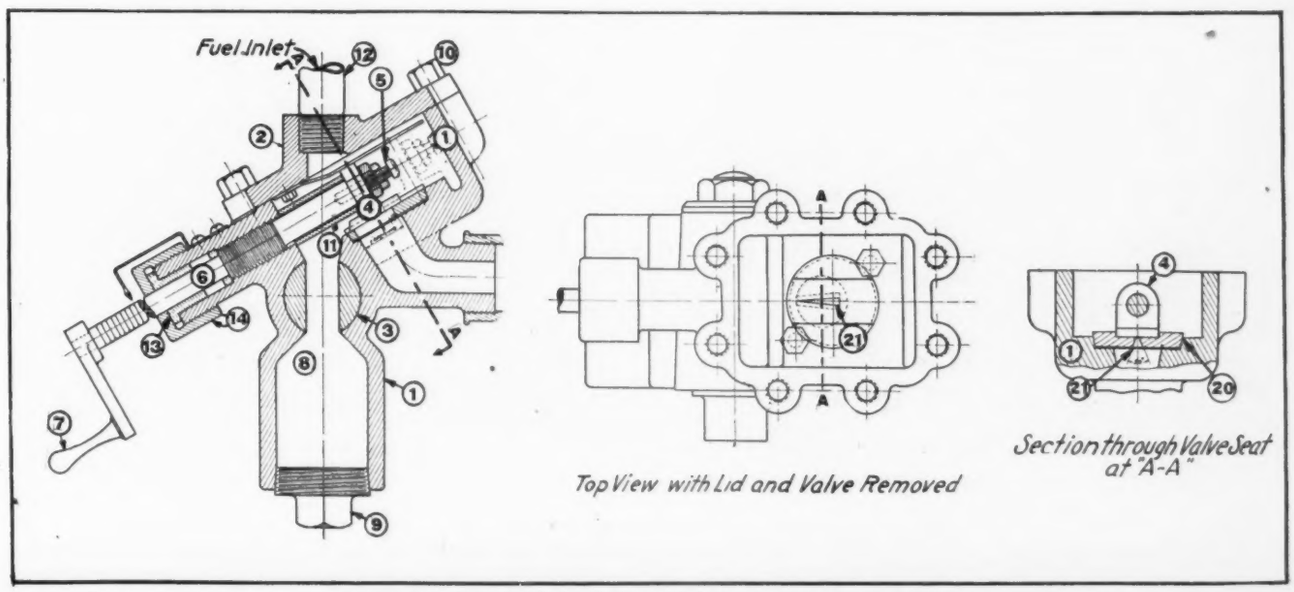
SHOWING CONSTRUCTION AND GENERAL FEATURES OF STRAIGHT TUBE FUEL OIL HEATER

Develop a Straight Tube Fuel Oil Heater

The Griscom-Russel Co., 90 West street, New York, manufacturers of fuel oil heaters of the coil type, recently have placed upon the market a new oil heater unit of the straight tube type. This heater, shown in the accompanying illustration is designed for the preheating of fuel oil before it goes to the burner, to insure complete atomization and perfect combustion under boilers or furnaces. The oil is pumped through the tubes and high pressure stem in the shell serves as a heating medium.

The shell of the heater is constructed of wrought steel welded to steel tube plates. The heads are cast iron and the tubes, seamless drawn steel expanded into tube sheets at either end. The shell and heads are designed to withstand a working pressure of 250 pounds per square inch.

Where conditions warrant, retarders of twisted steel are fitted in the tubes. They extend the entire length of the tubes and are fastened at each end. Their purpose is to agitate the oil passing through the tubes and thus increase the oil velocity and heat transfer rate.

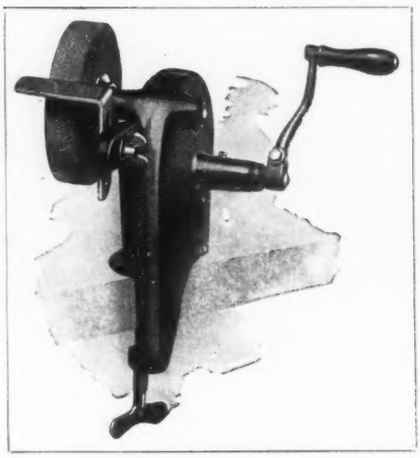


SECTIONAL VIEWS SHOWING CONSTRUCTION AND METHOD OF OPERATION

Hand Operated Grinder

Hand and foot power operated grinders are an excellent medium for sharpening drills, plane irons, chisels, etc., in cases where other power is not available. The grinder shown in the accompanying illustration is a recent development of the Luther Grinder Co., Milwaukee, Wis. This unit is offset at an angle for convenience in operating. It is clamped to a bench or table in a manner that eliminates overhanging. This feature, it is pointed out, tends to eliminate vibration.

The gear teeth are angular so that three teeth are in mesh simultaneously. This feature insures quiet action and a maximum wearing surface. The bearings are comparatively long for their diameters and are chambered to retain oil. Oil cups are provided for lubrication while the design of the pinion does away with cotter pins and nuts for end thrust adjustment.



HAND OPERATED BENCH GRINDER

Ship Furnaces Abroad

The rapidly developing demand for electric furnaces on the part of foreign melters of nonferrous metals is one of the important factors in the history of this industry this year. The Electric Furnace Co., Alliance, O., has just shipped two 105 K. W. Baily units to Norway where they will be used to melt zinc at the Jossingfyord plant in Stavanger, and to melt aluminum at the Norsk Aluminum Works at Christiana.

Complete rolling mill brass melting furnaces, designed for pouring the metal directly into the molds, have recently been shipped by this company to the Amsinck Corporation of Mexico, Mitsui & Co. of Japan, and Allen Everett, Ltd., of England. The adoption of electric melting by the largest and oldest brass tube mill in England is especially significant at this time. The Amsinck company already had a Baily tilting furnace for melting their brass cartridge slab. Both furnaces are for the Mexican government arsenal. In addition to these units, Baily electric furnaces have recently been installed at three Canadian plants: the Dominion Steel Products Co., Brantford, Ont, the Monarch Metals Co., Hamilton, Ont., and the Union Screen Plante Co. of Lennoxville, Que.

Cutting Cast Iron With Oxyacetylene Flame

The Oxweld Acetylene Co., Newark, N. J., recently demonstrated a method for cutting cast iron with a gas torch. A torch of the type employed to cut steel was used by the company in this demonstration. The principal differences in cutting the two materials are that a heating flame having an excess of acetylene must be used to prevent excessive oxidation while heating the casting. The cast iron must be heated to almost a molten condition to start the cutting reaction, while steel ignites at a point well below its melting point. Also, the nozzle of the torch must be held further away from the metal to cut cast iron and must be continually oscillated; that is, it is necessary to alternately preheat and blow away molten material in order to maintain the cut.

New England Foundrymen's Association Meet

The November meeting of the New England Foundrymen's association was held on Nov. 10 at the Exchange club, Boston. The principal speaker was Dr. Robert S. Quimby, service manager for the Hood Rubber Co., Watertown, Mass., who discussed present day industrial questions.

The consolidation of Whiting Foundry Equipment Company of Harvey, Ill., and American Foundry Equipment Company of New York City, recently announced, has not been consummated and the two companies will continue as separate concerns the same as heretofore.

Obituary

J. H. Baird inventor of automatic machinery used for making pins and other everyday products in large quantity died Nov. 14, 1920 at the home of Judge F. M. Peasley, Cheshire, Conn., at the advanced age of 92 years and 11 months. He was buried in Oakville, Conn., the same town in which he was born Dec. 9, 1827 and in which he had resided practically all his life. After the customary education of the period, a ground work of reading, writing and arithmetic he went to work at the age of ten in the shop of Scoville & Buckingham Co., of Oakville, now the Scoville Mfg., Co., Waterbury. He remained with the firm for nine years and then opened a small shop of his own in Huntingdon, Conn., which he operated for four years with indifferent success. He entered the employ of the Scoville & Buckingham Co. again in 1851, moved with them to Waterbury and stayed with them until 1854 when he went to Oakville and built what is now known as Slade's Mill. He disposed of this after a short time and in turn became connected with the Oakville Co., the Benedict & Burnham Co., now part of the American Brass Co., and the Naugatuck Machine Co. of Union City. The shops of the latter company burned down in 1878. He then formed the Baird Pin Co. and while retaining his interest he was again employed by the Benedict & Burnham Co. to improve their machinery. He then successively became interested in the Waterbury Machine Co, Baird Pattern shop and Henderson Bros., of Waterbury. Eventually he disposed of some of his interests and brought the others under one head and orgainzed the Baird & Warner Co., which shortly afterward was changed to the Baird Machine Co.

Chas. H. Morgan, vice president and manager of the Arcade Mfg. Co., Freeport, Ill., died in that city on Wednesday, Nov. 3 a few days after undergoing a surgical operation. He was born in Marlboro New York, Jan. 1, 1853. The following year the family moved to Freeport, Ill., where with the exception of two years spent in Missouri, he has lived all his life. After leaving school he learned the iron molder's trade in the shop of his uncle, the late Jerome Hazen, and continued in this business for many years. Eventually he and his brother Edgar Morgan were admitted into partnership by their uncle and became his successor when his death occurred. They sold out the business in 1891 and organized the Arcade Mfg. Co. The business was capitalized at $25,000 and they opened their plant with 25 employes. At the present time the capitalization is many times the original amount and the number of employes is several hundred. Mr. Morgan was married on Oct. 29, 1879, to Miss Alice Robey. She died in 1912 and in 1917 he married Miss Elizabeth Damour. He is survived by his widow and three children by his first wife; William in Chicago and Hazen and Allison, both of Freeport.

Foundry Equipment Demand Slack

Closing Weeks of 1920 Mark a Waiting Attitude on the Part of Buyers – Slump in Foundry Activities Has Set Forward Requirements for Labor Saving Machinery

WITH 1920 drawing to a close, foundry equipment manufacturers look back upon one of the most prosperous periods of their existence. Dating from the early summer of 1919, the demand for castings increased with greater insistence, orders were pyramided, and extensions and new foundries were constructed in such numbers that manufacturers could not keep pace with the demand for melting, molding, handling and conveying machinery eagerly sought by foundrymen. Throughout the year until August and September, the volume of foundry equipment business grew, impeded only to a slight degree by adverse shipping conditions which existed at times. With the first blight upon the foundry industry with which it is so intimately allied, the equipment manufacturers experienced a slackening in demand for their products. Cancellations were few, but new orders simply did not materialize until with the general slump in foundry activities during the past month practically no equipment has been contracted. At present there is some buying of machinery for replacement, and some incidental inquiry based upon contingencies after the first of the year, but a temporary stagnation governs in almost all lines.

Light Demand in Eastern Centers

DULLNESS dominates the eastern foundry equipment market. Some sellers assert that demand is the lightest since prewar days and that while there are numerous projects in abeyance, there is little likelihood, in view of general conditions, of the revival in trading in the near future.

This slump follows a period of unusual activity. Throughout the first seven months or so of this year, there was a heavy demand for castings, and as a result, foundry concerns built new additions and casting consumers, owing to unsatisfactory deliveries, added foundry departments to their own plants. The curtailment of operations in the automotive industry, followed by the depression throughout industry, generally, brought a halt to such building activity.

Included among recent buyers are the Ross-Meehan Foundries, Chattanooga, Tenn., which closed on two 3-ton electric cranes and some miscellaneous equipment; the Kutztown Foundry & Machine Co., Philadelphia, and the Dominion Foundry & Steel Co., Ltd., Hamilton, Ontario, this concern closing on some hoisting equipment.

Perin & Marshall, 2 Rector street, New York City, are figuring on approximately $15,000 worth of miscellaneous equipment for the Tata Iron & Steel Co., Sakchi, India, and the Electric Alloy Steel Co., on a 1-ton crane, with 16-foot span, and some charging and drawing equipment.

Chicago District Waits

IN COMMON with other lines of business, the general attitude of buyers of foundry equipment and supplies, as well as those interested in building new foundries or making additions or alterations to existing plants, is that they will not buy at present. Most foundries are operating much under capacity and while some are managing to hold their organizations together, others are down to a low point. Some selling of second hand equipment is being done where concerns with excess machinery or appliances are anxious to sell in order to realize cash, and some bargains are being picked up in this way. Engineers who specialize in foundry construction and planning, find considerable demand for their advice which is described as "shopping." This means that while considerable building is being planned for, the builders are not yet ready to go ahead with construction, holding to the belief they will make money by waiting until materials, labor and other items are lower. Some cuts in prices of cranes have been noted, but for the most part prices are unchanged.

Pittsburgh District Requirements Limited

MAKERS of foundry equipment report that while the market is relatively quiet, there still is fair demand. Producers of such lines as sand mixers and magnetic separators say that there is a somewhat better demand for both of these lines and deliveries are being made in 30 to 60 days. Producers of air compressors and accessories, such as reservoirs, gages, regulating valves, nozzles and hose are operating at capacity and have a good volume of unfilled orders on their books. Both steel and gray iron foundry interests are taking only moderate lots of refractories.

What the Foundries Are Doing

Activities of the Iron Steel and Brass Shops

The Bridge & Beach Stove Co., St. Louis, recently completed the erection of an addition to its plant.

The foundry at the plant of the Concord Axle Co., Penacook, N. H., recently was damaged by fire.

The plant of the Lundblad Foundry Co., South Haven, Mich., recently was damaged by fire.

The plant of the Galesburg Malleable Casting Co., Galesburg, Ill., recently was damaged by fire.

The capital stock of the Standard Malleable Iron Co., Muskegon Heights, Mich., recently was increased from $250,000 to $500,000.

Capitalized at $500,000 the Preston Cast Die Corp., Boston, recently was incorporated by Marshall V. Preston, Alfred B. White and S. D. Converse.

The pattern shop at the plant of the Wheeling Steel Castings Co., Wheeling, W. Va., recently was damaged by fire.

Capitalized at $25,000, the Cook Air Valve Co., Charlotte, N. C., recently was incorporated by William T. Cook, W. M. Crosby and H. T. Maner.

The Acme Die Casting Corp., 87 Thirty-fifth street, Brooklyn, N. Y., recently increased its capital stock to $275,000.

Erection of an addition to its plant is being planned by the Ideal Foundry Co., Grand Rapids, Mich.

Erection of an addition to its foundry, 30 x 50

feet, is being planned by the Mountain City Foundry & Machine Works, Greenville, S. C.

The plant of the Utica Valve & Fixture Co., Utica, N. Y., recently was damaged by fire.

The Joplin Foundry Co., Joplin, Mo., Seventh and Missouri streets, is having plans prepared for the erection of a foundry building, 50 x 50 feet.

The foundry of the H. A. May & Co., Sixty-first street and Eastwick avenue, Philadelphia, recently was damaged by fire.

Erection of an addition to its plant, 24 x 100 feet, is being planned by the New York Car Wheel Co., 15 Forest avenue, Buffalo.

T. A. Parey, 917 Conwell street, Connersville, Ind., is building a plant and is reported in the market for machine shop and foundry equipment.

The Best Stove & Repair Co., Cleveland, recently was incorporated with a capital stock of $15,000, by C. H. Rolf, C. A. Walder, and others.

The foundry at the plant of the Superior Gas Engine Co., Springfield, O., recently was damaged by fire.

The Zenith Foundry Co., Miller avenue, Detroit, plans the erection of a foundry building, 90 x 200 feet.

The C. & G. Cooper Co., engine builder, Mt. Vernon, O., has advised that it has indefinitely postponed the erection of a new plant, plans for which have been prepared.

Capitalized at $100,000, the Charles R. Hilb Metals & Refining Co. recently was incorporated by C. R. Hilb, L. C. Hilb, G. Battman, M. Mitchell and H. J. Cohen.

The Superior Washing Machine Co., DeKalb, Ill., which has plans for the erection of a foundry and warehouse, has deferred the erection of these buildings.

The Lycoming Foundry & Machine Co., Oliver street, Williamsport, Pa., is having plans prepared for the erection of a power house, 1-story, 50 x 100 feet.

H. P. and A. X. Gaukler, Franklin boulevard, Pontiac, Mich., has plans for the erection of a foundry, 40 x 100 feet, to be built at Lake street and the Grand Trunk railroad, Pontiac.

The Pennsylvania Furnace & Stove Co., Warren, Pa., is enlarging its plant by the erection of an addition, 60 x 120 feet, work on which is expected to be completed shortly.

Instead of building a foundry and machine shop of its own, as planned, the Antigo Tractor Co., Antigo, Wis., has purchased the plant and equipment of the Murray-Myrea Co., and has taken possession of the plant.

The Gaylord Foundry Co., 2601 East Twenty-sixth street, Los Angeles, recently was organized to manufacture iron and steel castings, by Robert H. Gaylord, 1814 Virginia road, Los Angeles, and others.

Fire damage recently sustained by the Modern Steel Casting Co., Milwaukee, was slight, and the plant is running at normal capacity, according to a statement by L. G. Smith, president and general manager.

The Interstate Foundries Corp., Boston, recently was incorporated with a capital stock of $150,000, by Herbert Austin, South Somerset, Mass., J. P. Sokoll, Fall River, Mass., R. B. Delano and Charles M. Smith.

The Huron Specialty Casting Co., Goderich, Ont., is contemplating establishing a foundry and manufacturing plant and is asking the city to erect a building, sell it to the company, and grant the usual exemption from taxes.

Work will be started soon by the Claypool Foundry Co., Claypool, Ind., on the production of machinery and castings. The company recently was incorporated with a capital stock of $50,000, by Frank O. Borg, A. J. Humely and E. A. Miller.

Gerardus Harrison, architect, 103 Park avenue, New York, will make all purchases for the proposed foundry to be erected by the Lima Foundry & Machine Co., Lima, O., which is affiliated with the Wheatley Co., Lima. Plans are now being prepared.

Equipment for assembly purposes will be all that will be required by the Peters Motor Corp., Trenton, N. J. This company recently took over the foundry property of the Reeves-Cubberly Engine Co., Trenton, and now is engaged in converting it into a plant for assembling automobiles. L. H. Worne has charge of the engineering department.

The Canadian Hanson & Van Winkle Co., Toronto, Ont., has completed the erection of an addition to its foundry, for the manufacture of gray iron castings for the machine trade.

Advices have been received from the Manufacturers Foundry Co., Waterbury, Conn., to the effect the recent increase in its capital stock from $200,000 to $400,000, was made to care for possible future developments, but at present there are no plans for enlarging the company's plant or the purchase of additional machinery and equipment.

The W. B. George Foundry Machinery Co., 3933 Colorado avenue, Chicago, is about to bring out a line of split-pattern molding machines for the production of small castings, such as valves and fittings. W. B. George is president of the company and A. W. George, is vice president. The company recently took over its present plant which has been equipped for production of the new line.

The Canadian Pattern & Castings Co., Ltd., has been organized to manufacture wood and metal patterns, and castings in brass, aluminum and bronze. J. C. Greer, 123 Monroe avenue, Detroit, is president of the company, which is located at Ford City, Ont.

The capital stock of the Pattern & Foundry Equipment Corp., 132 Nassau street, New York, recently was increased from $10,000 to $50,000.

Coincident with an increase in capitalization of the Universal Pattern & Model Co., Hartford, Conn., comes a change in the personnel of the officers. Edward W. Putnam has been elected president; Edward M. Long, vice president; Edward S. Goodwin, treasurer, and Charles E. Baker, secretary. Mr. Putnam has been with the company since its incorporation in 1902. The plant of the company is located in the Hartford Wire Works building, and is equipped with modern machinery.

General offices of the Kenney Foundry & Mfg. Co. will remain at 19 East Third street, Mansfield, O., although it has opened a new plant at Lexington, O. A general store room will also be maintained at Mansfield for the storage of castings for that city's trade. The buildings of the new plant are located along the Baltimore & Ohio railroad tracks and the company has its own railroad siding and power plant. The largest building houses the foundry and is 90 x 200 feet. Its machine shop is equipped with machines which were saved when its Mansfield plant was damaged by fire, although considerable new equipment has been added. A complete pattern shop is also maintained.

Due to the increase in the demand for its products, chiefly stoves, ranges, ovens and heaters, the Jackson Stove & Stamping Co., Jackson, Mich., recently increased its capital stock from $200,000 to $2,000,000. The company plans soon to place on the market a hot water heater, utilizing kerosene oil for fuel, a new collapsible baking oven and a folding camp stove. Eventually its producing facilities will be increased tenfold which will necessitate new buildings as well as considerable new equipment. Decision regarding building expansion, however, has not been reached nor has the company come to a definite conclusion regarding its machinery requirements, announcements concerning which, will be made later, according to a statement by E. B. Hall, president and general sales manager.

New Trade Publications

THREAD CUTTING MACHINERY.—The Landis Machine Co., Waynesboro, Pa., has published an illustrated booklet in Spanish for circulation in Spanish-speaking countries. In it thread cutting machinery is described and illustrated.

HANDLING MACHINERY.—Material handling machinery, such as electric traveling cranes and motor hoists, are described and illustrated in a 4-page illustrated booklet recently published by the Franklin Moore Co., Winsted, Conn.

BORING MILLS.—The Cincinnati Planer Co., Cincinnati, is circulating a 32-page illustrated booklet in which boring mills of various sizes are described and illustrated. A general description is given, as are specifications and other data.

ELECTRODES.—Electrodes in use in electric furnaces of various types are shown in an illustrated booklet being circulated by the Acheson Graphite Co., Niagara Falls, N. Y. The furnaces shown are typical of the various classes of furnaces in which electrodes are used.

POWER TRANSMISSION MACHINERY.—The A. & F. Brown Co., Elizabethport, N. J., is circulating its new 130-page illustrated catalog in which power transmission equipment and various accessories are described and illustrated. Complete data and specifications are given.

CRANES.—The Milwaukee Electric Crane & Mfg. Co., Milwaukee, is circulating a 48-page illustrated booklet in which electric cranes and hoists are described and illustrated. The cranes are of strong rigid construction, bearings are self-oiling and the entire bridge drive gearing is enclosed and runs in oil. All parts are readily removable.

HEATING SYSTEM.—Skinner Bros. Mfg. Co., St. Louis, has published a 4-page illustrated folder in which a plant heating system is described and illustrated. According to the folder, this heater operates without a complicated system of pipes or ducts for air distribution. It does not require special foundations, and may be set on any floor that will sustain a load of 175 pounds per square foot.

MINE EQUIPMENT.—A 48-page illustrated booklet has been published by the Cutler-Hammer Mfg. Co., Milwaukee, in which various electrical equipment for use in and about mines is described and illustarted. The equipment includes motor-control and battery-charging equipment; electrically-operated brakes; iron-clad solenoids; magnetic separators; magnetic clutches; electric space heaters, soldering irons, etc.

RUST REMOVER.—Peter A. Frasse & Co., Inc., New York, is circulating an 8-page illustrated leaflet in which a rust remover, preventative and cleanser for machines, engines, tools and all metal surfaces is described. According to the folder the solution is a combination and blending of certain chemical ingredients which neutralizes and dissolves rust, grease, oil, dirt, carbon, paint, etc., that is present on any metal surface.

BELTS—A 56-page illustrated booklet is being circulated by I. B. Williams & Sons, Dover, N. H., in which leather belting, flat and round, rawhide and tanned lace leather, goodyear welting, etc., are described and illustrated in detail. The booklet contains rules, tables, etc., pertaining to the use of belting. Rules for lacing a belt are also given. The latter part of the booklet contains a number of full-page illustrations showing various parts of the company's plant.

SPACE HEATERS—The Cutler-Hammer Mfg. Co., Milwaukee, is circulating an illustrated booklet in which the various uses to which electric space heaters can be put, are pointed out. These heaters were designed originally for crane cab and miscellaneous heating around steel mills and other large industrial plants, but due to its wide adaptability it has entered the merchandising field and are now used in a wide general field. The booklet shows the various ways in which they are used, and gives, watt ratings and operating temperatures, and rules for estimating number of heaters.

PLUMBAGO

Our Plumbago Facings and Blackings are **Standard** the world over. Their quality is the **Highest**—They are cheapest in the end.

MOULDING SANDS

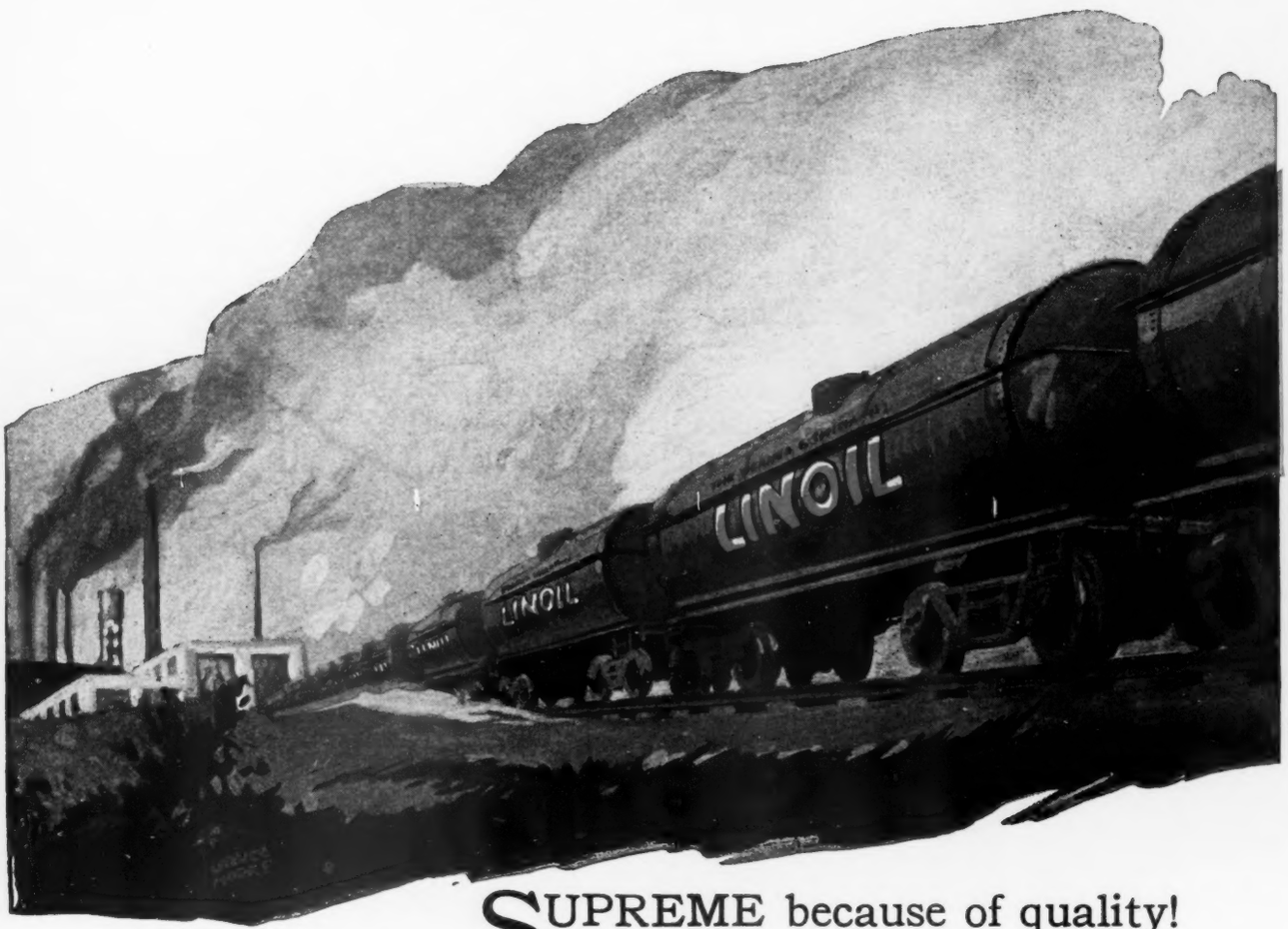
We are prepared to fill all orders from our big chain of operations in New York and New Jersey—each Sand the cream of its district including—Albany, North River, Amboy, Lumberton and Millville Silica Sands. Also Fire Sand, Millville Gravel, Washed Silica Sands, Sand Blast Sands, Clays, Etc.

CHARLES PETTINOS

MAIN OFFICE
25 CHURCH ST., NEW YORK

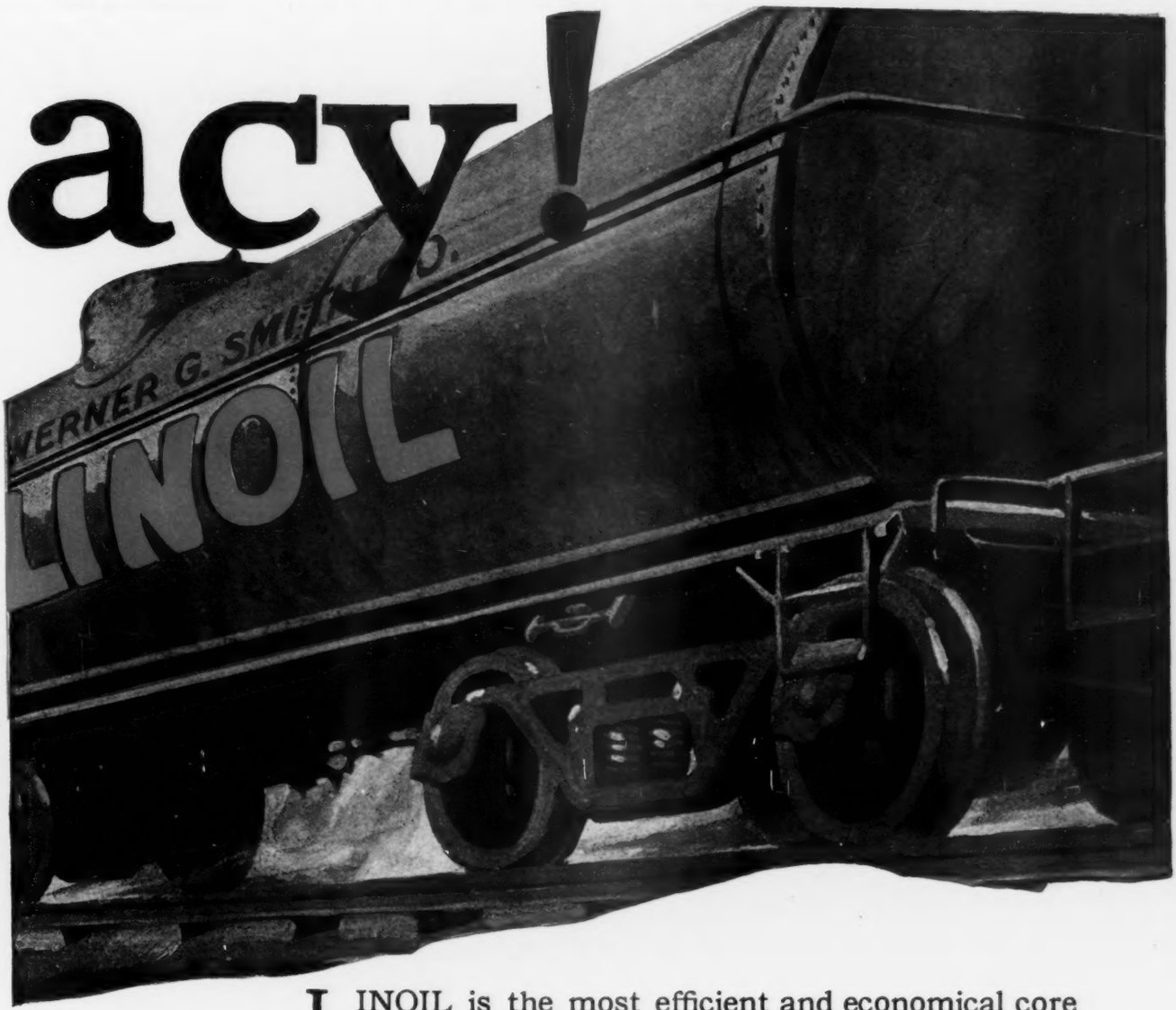
PHILADELPHIA BOSTON

Suprem



SUPREME because of quality! Had Linoil been only an ordinary oil, neither advertising nor luck would have made it so widely used by foundrymen.

LINOIL



LINOIL is the most efficient and economical core oil and that is why it is the most extensively used. It is endorsed by thousands.

Do you use it?

THE WERNER G. SMITH CO.

Cable Address "Wersmithco." **CLEVELAND, OHIO, U. S. A.**

The only concern in the United States manufacturing and selling core oil exclusively.

Chicago **Philadelphia** **Indianapolis** **Boston**

"THE LOGICAL OIL FOR CORES"

LINOIL

PANGBORN

Turn the Business Lull to Your Advantage

Be like the man who "was handed a lemon" and immediately set up a lemonade stand.

Reorganize your operations to make a saving in labor of more than your drop in profits due to decreased production.

Sand-Blast Equipment is either an Investment or an Expense.

"Pangborn" Service will analyze your Conditions and Requirements through careful and exhaustive study by Competent, Practical and Experienced Engineers.

"PANGBORN" SAND-BLASTS

installed on this basis eliminate all "speculation" and pay big dividends.

"Kill two Birds with one Stone"—be prepared for the rush that is coming quickly. Others have cut their Cleaning Room labor costs in half and produced better looking castings too.

Your requirements are "different" of course. We will find the difference and demonstrate the saving you can make.

"A Type and Size for Every Requirement."

PANGBORN

CHECK UP YOUR CLEANING ROOM PAYROLL

HOW LONG HAVE YOU BEEN PAYING OUT TWICE AS MUCH AS NECESSARY?

Are you paying out every year in labor more than enough to pay for Equipment that you don't have the advantage of—Equipment that would save its cost every year and improve your product too?

Refer to file G

Jan. 28, 1919.

Pangborn Corp.,
Att. of Mr. W. C. Lytle.
Hagerstown, Md.

QUOTATIONS SUBJECT TO CHANGE WITHOUT NOTICE. ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRE, ACCIDENTS AND OTHER DELAYS UNAVOIDABLE OR BEYOND OUR CONTROL. PATTERNS LEFT AT OUR FOUNDRY ARE DONE SO AT THE OWNER'S RISK.

PANGBORN CORP. JAN 30 1919

Gentlemen:

We have your letter of the 22nd relative to founiry men who are contemplating sanibiast, we cannot give you the detail that you ask for in regari to the workings of the sanibiast in connection with our cleaning previous as we never have kept our cost to show it in that way, but can tell you in the count of men the before ani after. Before we installei the sanibiast we were melting about twenty five tons of castings per iay ani cleanei them by hani with wire brushes ani rub stones but hai compresseci air so that the chipping was all ione by pneumatic chisels. We were employing in our cleaning room at that time sixteen chippers at thirty cents an hour, we installei the sanibiast and aiiei an operator at thirty cents an hour, inside of one week we hai reiuceci our cleaning force in the chipping room exactly one half ani was producing a cleaner ani better looking casting then when we hai the regular force. As a matter of fact we saved in wages in the first eleven months enough to pay for our entire sanibiast equipment. From your letter we wouli juige that the founiry mentioned iii not have any air for any of their work, if they are trying to operate a founiry in that way in these times, they are surely back numbereci

Very truly youre,

GEC/G

Before
16
Chippers @ 30 ¢ hr $4.80
8 hour day $38.40
26 days $998.40
Monthly —

After $499.20
½ of above
+ 1 Operator $2.40 $6.40
26 days @ $561.60
Monthly

Before — $998.40
after — $561.60
Monthly $436.80
11
Saved in 11 months. $4804.80

You need it NOW to offset Reduced Business!

You need it when the Rush is on and Labor scarce to get your Production out.

LOOK OVER THE PAYROLL BOOK TODAY.

PANGBORN CORPORATION
HAGERSTOWN, MD.
SAND-BLAST SPECIALISTS
P. O. BOX 851

Just One Barrel

of Kellogg's Core Oil will prove that you can get a better core and a truer casting than with any other core oil on the market.

You can bank on cores coming clean from core-boxes. You can feel sure that they can be stored indefinitely and not lose their stamina. Furthermore, they will break into free-running sand after every pour.

As to uniformity, quality, and economy, every Kellogg Standard Core Oil is made by skilled chemists who know foundry requirements and can give you the core oil that will fit your job. Ask us to send you just one barrel.

Spencer Kellogg & Sons, Inc.
Buffalo, New York

KELLOGG'S THE TEST TELLS 1824

KELLOGG'S

Kellogg's

Standard Core Oils

Kelloil	No. 10
"Gold Bond"	Radiation Special
Gold Bond X	Skasco
Gold Bond XX	No. 1

Cylinder Core Special

If you wish it, we shall be pleased to send our representative — a trained foundryman. He will gladly confer with you and explain why it will pay you to use Kellogg's Core Oils.

Spencer Kellogg & Sons, Inc.
Buffalo, New York

KELLOGG'S THE TEST TELLS 1824

CORE OILS

Trouble Proof
Core Oil—

To thousands, *Peffer Core Oil* needs no introduction. It is a widely known, thoroughly tested Core Oil that has, for over fifty-eight years, been used throughout the Country with greatest success.

But it is those foundrymen who are still having core troubles, that we wish our message to reach.

Peffer Core Oil consists of a pure linseed base, in which the compounded oil is thoroughly incorporated. Thus the entire amount of oil is uniform. And as there is absolutely no residue, every drop is usable.

Our new scientific method of treating linseed causes it to expand and contract in sympathy with the changes in temperature. This flexibility prevents the core from warping or cracking. *Peffer Core Oil* is pliable, so that the sand contains the air vents and allows the gas to escape freely.

Cores made with *Peffer Core Oil* bake quickly and are hard to the center.

We shall be glad to send you a trial shipment.

PAINE & COMPANY
WILKES-BARRE, PA.

HOLLAND STRAIGHT TRIPOLI PARTING

"Mr. Foundryman"

Why be bothered with poor "Makeshifts" when you can obtain *Holland Straight Tripoli Parting,* the premier and ideal material which is *always right* and *never fails* to make a perfect lift. Prompt and efficient service in shipment. Your first order will convince you.

Order today.

Holland Core Oil Company

4600-8 W. Huron St.
Chicago, Ill.

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HITS THE MARK

"KELCO" CEYLON LEAD

WE GUARANTEE THIS TO BE THE BEST LEAD FACING ON THE MARKET

CARRIED IN STOCK

Ceylon Lead	Core Oil	Pitch Compound
Silver Lead	Molasses	Galvanized Pails
Plumbago	Soft Brushes	Wooden Buckets
Graphite	Wire Brushes	Wooden Mallets
Core Wash	Coke Forks	Rawhide Mallets
Blacking	Shovels	Bench Rammers
Seacoal	Scoops	Floor Rammers
Parting	Riddles	Goggles
Glutrin	Bellows	Gloves
Goulac	Chaplets	Swabs
Flour	Torches	Fillet

ORDER A BARREL ON APPROVAL

STOP BAD CASTINGS
SAVE LABOR LOSSES
CUT CLEANING COSTS

IF NOT AS GUARANTEED RETURN AT OUR EXPENSE

FAIR—ISN'T IT?

ESTABLISHED 1885

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355 WEST 26TH STREET
NEW YORK

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CHICAGO, ILL.
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MILLS:
IRWIN, PA.
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MAKING CUSTOMERS

Are you interested in scientific foundry practice? We are; and that Bloomsbury Foundry Facings may even more exactly meet the most modern requirements, we have retained the well-known expert, Dr. Moldenke, who has put his deductions all down in a very helpful book, "*Foundry Blackings*," which we have just published for our mutual benefit. Where shall we send your copy?

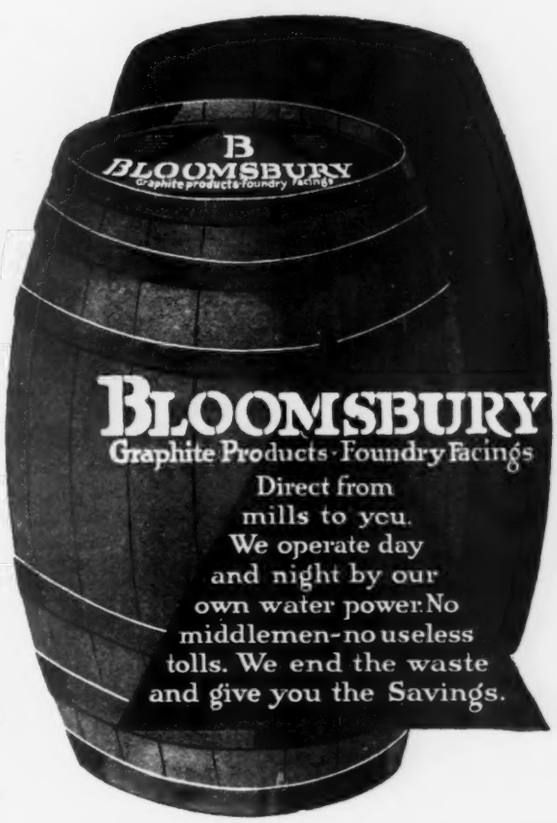
BLOOMSBURY
QUALITY PRODUCTS

Include

Mill No. 1
Graphite
Plumbago
Silver Lead

Mill No. 2
Graphite Blacking
XXX Mineral Blacking
Anthracite Blacking

BLOOMSBURY GRAPHITE CO.
Mills Established 1882
Bloomsbury New Jersey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BLOOMSBURY
Graphite Products · Foundry Facings
BLOOMSBURY
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Direct from mills to you. We operate day and night by our own water power. No middlemen-no useless tolls. We end the waste and give you the Savings.

New Jersey Zinc Co.

The world's standard for Zinc products

SLAB ZINC
(SPELTER)

Manufacturers of brass, galvanized wire, ornamental bronze and other products, will find New Jersey Spelter exactly suited to their requirements. Two of our grades of spelter

Horse Head and Bertha Brands

produced from the unique zinc ores of our Franklin, New Jersey, mine, average more than 99.94 per cent pure. They are entirely free from cadmium and other deleterious impurities, and are most advantageous for use in making the best brass, in slush castings, in special galvanizing, and in other particular work.

We also manufacture Strip Zinc for roofing, gutters, leaders, and various other metal products.

THE NEW JERSEY ZINC COMPANY, 160 Front Street, New York
Established 1848

CHICAGO: Mineral Point Zinc Company, 1111 Marquette Building
PITTSBURGH: The New Jersey Zinc Co. (of Pa.), 1439 Oliver Building

BASIC UNIFORMITY.

THE FOUNDATION OF QUALITY in every manufactured product. There is no profit in using a core oil that does not produce uniformly good cores—you lose dollars and cents with every flaw that develops.

Painstaking selection of raw materials, scientific compounding, and the most modern manufacturing facilities are the reasons responsible for the basic uniformity and superior efficiency of

Union Korbind Oil

—The giant of all Core Oils. Unusually strong in binding qualities, KORBIND OIL forms sturdier cores with the use of less oil, increasing production, diminishing smoke and gases, and eliminating losses due to defective cores.

In the interest of uniformity, economy and increased production you owe it to yourself to give KORBIND OIL a trial. Allow us to make an impartial test under actual working conditions in your foundry. WRITE TODAY.

Union Petroleum Company

Philadelphia—Chicago

New York *Pittsburgh* *Kansas City* *San Francisco*

-follow the trail

BUFFALO BRAND
VENT WAX
NOTICE.
This wax is sensitive to extreme heat and cold.
If too soft, place in a pail of cold water before unwinding, or, if too hard, warm slightly.
ADVISE US OF ANY TROUBLE.
THANK YOU.

Buffalo Brand Vent Wax

makes Economy Double-Sure

Saves your castings from the scrap pile.

Increases your production of perfect castings.

The ***"Buffalo Brand"*** is a combination of different waxes. It is absorbed by the core when drying, and forms a clean venthole, just the size of the wax used.

A trial of a sample will convince you of its worth.

Order from your supply house or write us.

UNITED COMPOUND CO.

228 ELK STREET BUFFALO, N. Y., U. S. A.

FACINGS

Our Three Standard Brands

GEOGRAPH

CEYLOGRAPH

MEXIGRAPH

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Armor Blacking

—o—o—o—

Moulding Sands

—o—o—o—

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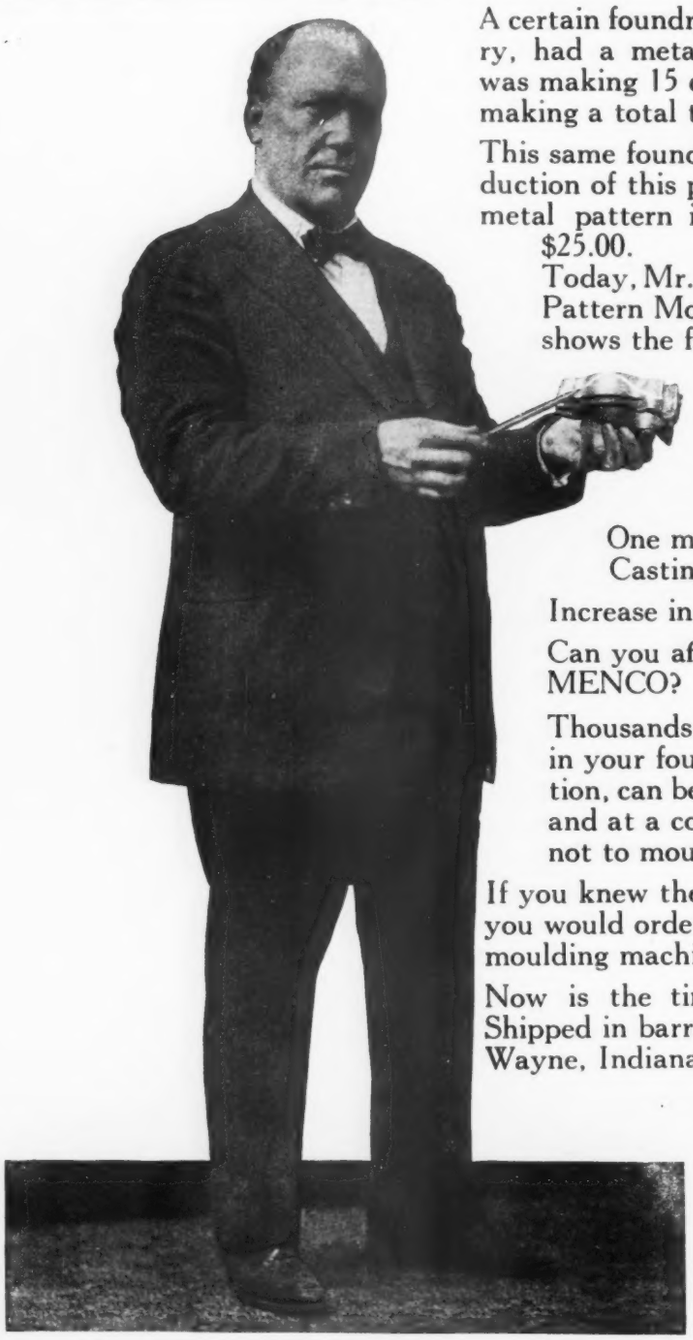
Messrs. R. J. Mercur & Co., Ltd.
Montreal, Canada

MOUNTING YOUR METAL PATTERNS IN MENCO

A *FACT* THAT READS LIKE A FAIRY-TALE



A certain foundryman, operating a Grey Iron Foundry, had a metal pattern, from which one moulder was making 15 castings per day at 37 pounds each, making a total tonnage of 555 pounds.

This same foundryman desired to increase the production of this particular casting and mounted this metal pattern in MENCO at a cost of less than $25.00.

Today, Mr. Foundryman is operating a MENCO Pattern Mount on a Moulding Machine which shows the following result.

One man, operating MENCO Pattern Mount on a moulding machine produces 50 castings per day weighing 37 pounds each, or a total tonnage of	1,850 Pounds
One moulder making 15 Castings at 37 lbs. each	555 Pounds
Increase in production	1,295 Pounds

Can you afford to operate a foundry without MENCO?

Thousands of patterns that are being operated in your foundry today, at a minimum production, can be mounted in MENCO in a few hours and at a cost so small, that you cannot afford not to mount them.

If you knew the value of MENCO in your foundry, you would order a barrel today. MENCO and the moulding machine means increased production.

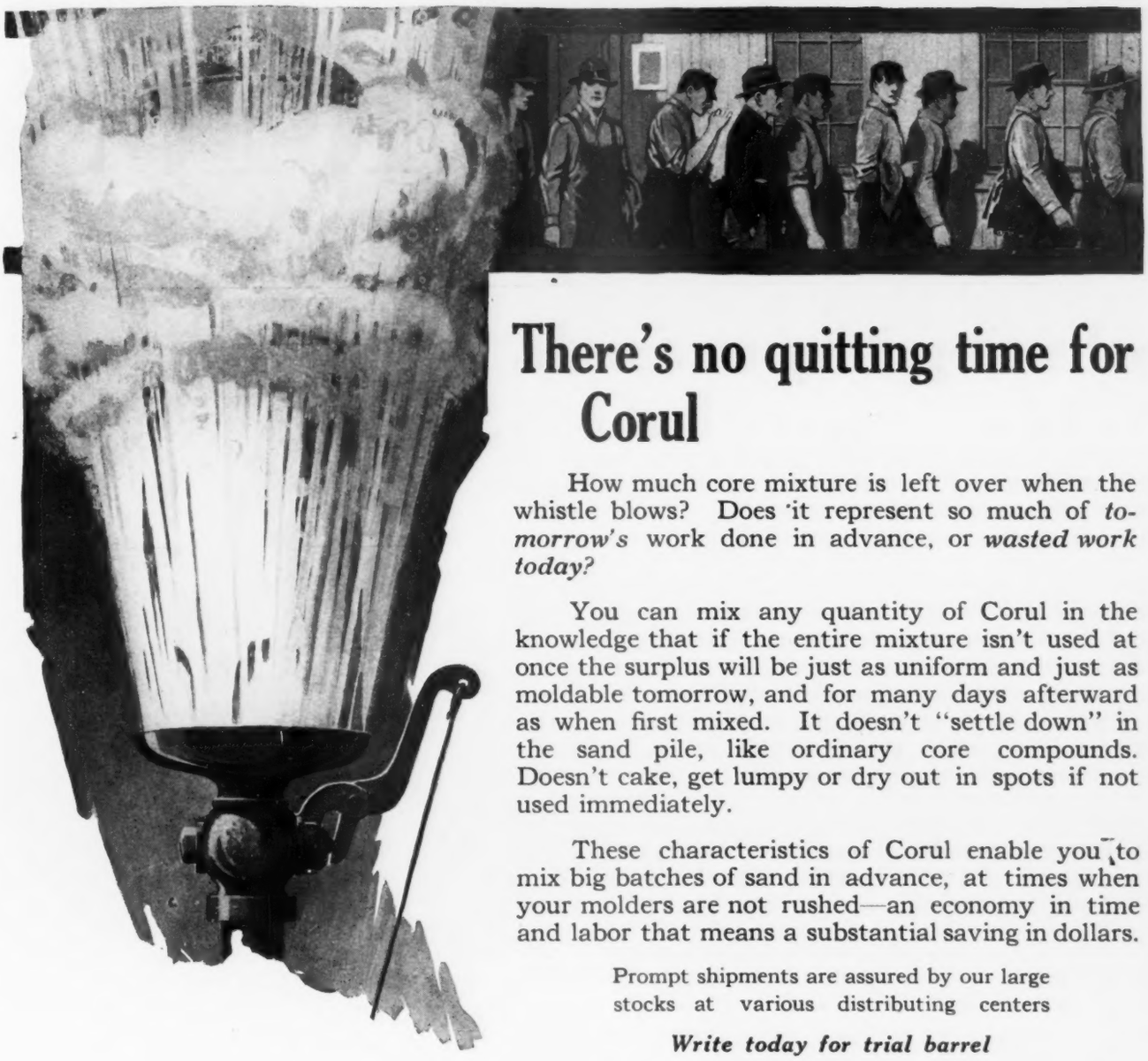
Now is the time to order a barrel of MENCO. Shipped in barrels at 12 cents per pound, FOB Ft. Wayne, Indiana.

Manufactured and sold by

The Menefee Foundry Company

Fort Wayne Indiana

Patented April 6, 1919, and May 6, 1920.



There's no quitting time for Corul

How much core mixture is left over when the whistle blows? Does it represent so much of *tomorrow's* work done in advance, or *wasted work today?*

You can mix any quantity of Corul in the knowledge that if the entire mixture isn't used at once the surplus will be just as uniform and just as moldable tomorrow, and for many days afterward as when first mixed. It doesn't "settle down" in the sand pile, like ordinary core compounds. Doesn't cake, get lumpy or dry out in spots if not used immediately.

These characteristics of Corul enable you to mix big batches of sand in advance, at times when your molders are not rushed—an economy in time and labor that means a substantial saving in dollars.

Prompt shipments are assured by our large stocks at various distributing centers

Write today for trial barrel

S & F PARTING—the recognized standard. Used by leading foundries.

SWAN AND FINCH COMPANY
NEW YORK

Quality Lubricants Since 1853

Chicago, Philadelphia, Pittsburgh, Boston, San Francisco, Buffalo, Detroit, New Orleans, Atlanta, Charlotte, N.C.

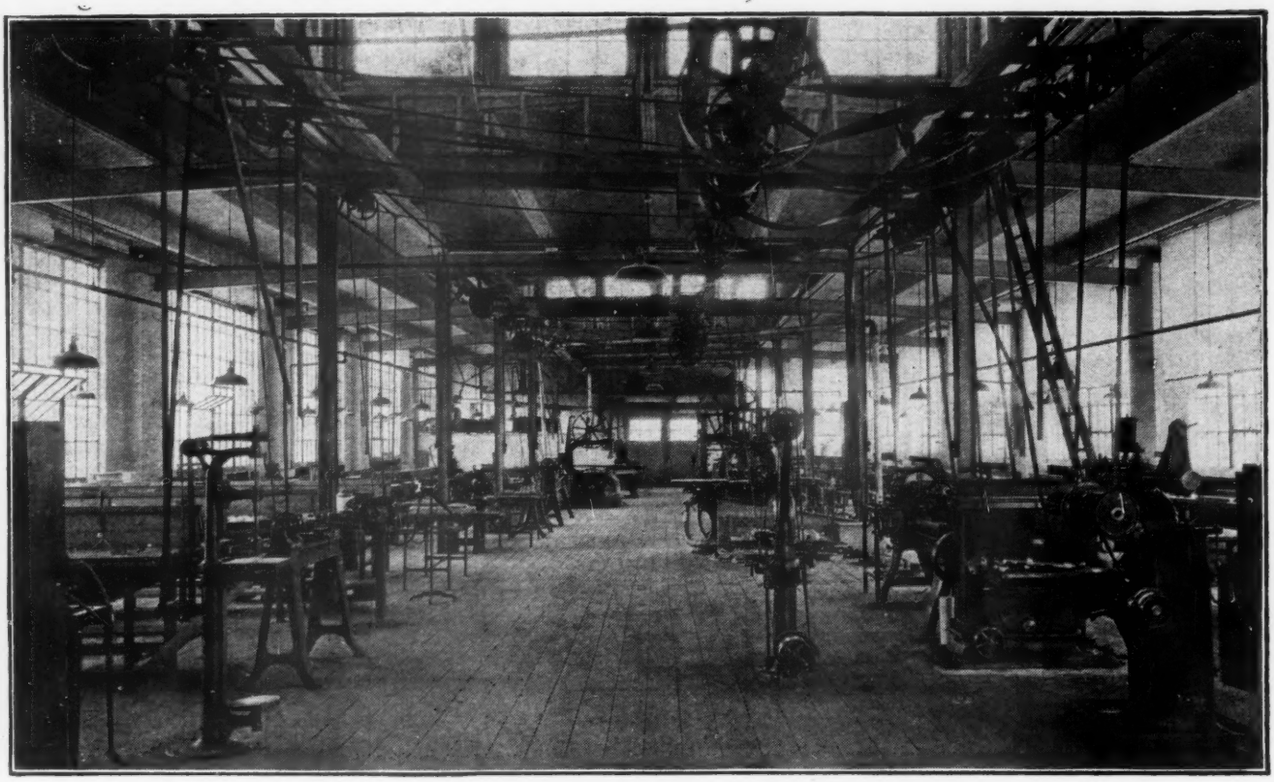
CATARACT REFINING COMPANY
Limited
Toronto, Canada London, England

CORUL

The Scientific Core Oil that Meets the Twelve Requirements of Core-Making

PATTERNS

WOOD AND METAL



THE MOTOR PATTERNS CO.

Satisfaction means a Repeat Order

From a Satisfied User—With our New Plant affording a maximum of light, equipped with the most Modern Machinery, we are prepared to take care of our Increased Orders, and concentrate our efforts upon the manufacturing of Perfect Patterns.

PERFECT PATTERNS PRODUCE A-1 CASTINGS

Forward Us Your Blue Prints

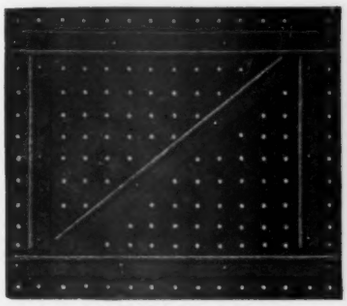
The Last Word in Equipment

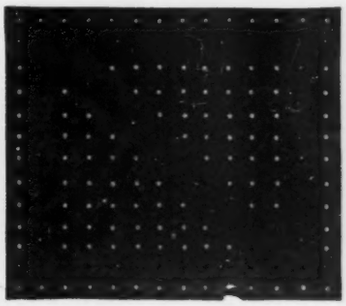
THE MOTOR PATTERNS COMPANY

East 61st St. and Waterman Ave. Cleveland, Ohio

Every Man a Specialist

THE WADSWORTH
All-Steel Bottom Plates





GUARANTEED

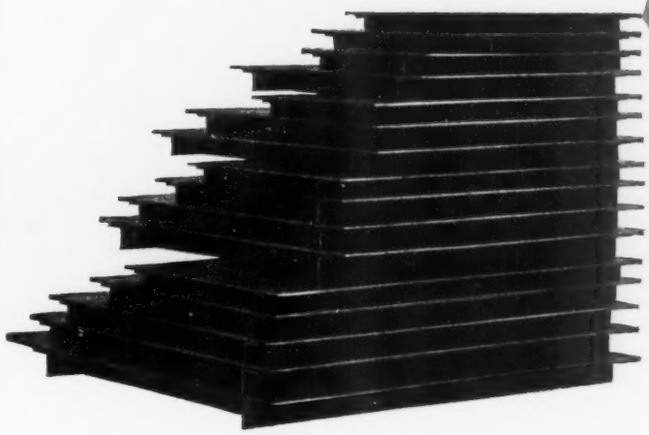
Perfect Core Tray or Plate

With our method of straightening and reinforcing with angles.

A perfectly straight non-warpable plate is secured.

Weigh but 1-3 as much as cast iron plate, cannot be destroyed by burning, 15 years on the market and still satisfactory.

We can furnish plates made from ARMCO Rust Resisting Iron if so desired

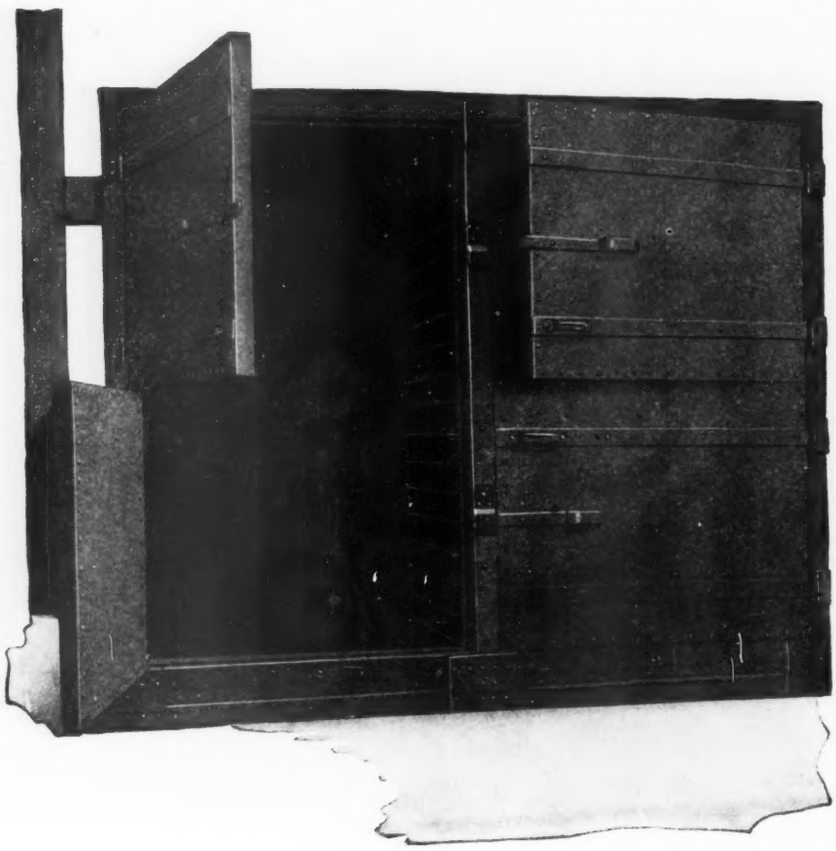


All-Steel Core Trays

The Wadsworth
Core Machine and Equipment Company
Akron, Ohio, U. S. A.

"ALL STEEL" QUICK DRYER TYPE OVEN

COAL—COKE—GAS—OIL—ELECTRICITY



FOR delicate and continuous baking the ALL STEEL QUICK DRYER type oven should be used. The temperature in it may be increased far above the degree considered safe in other ovens.

Shelves in this oven may be adjusted. Work of varied size may be baked at the same time under the more intense heat provided.

Two Types of This Oven There are two types of Quick Dryer Ovens. The Single Side and Double Side. The Single Side is an oven of single depth with doors on one side. The Double Side type is in reality two ovens placed back to back with one common wall and having doors on both sides.

Straight Line Production The Single Side ovens can be equipped with doors on both sides. This is an important feature for foundries developing straight line production.

Standard Quick Dryer Ovens are 3' 8" deep and 6' 6" high. The width of the door is 3' 9". The smallest unit is approximately 8' wide. Each additional unit is approximately 4' wide. Any number of units may be joined.

We make ovens of this same construction in car and rack type designs; also a portable oven; besides the racks, cars, lifting trucks, etc., etc.

J. S. McCORMICK CO.

Foundry Supply Depot

PITTSBURGH, PA.

ESSO
TRADE MARK REGISTERED

To the Foundrymen of the United States:

The experience which we have gained during the past forty-seven years combined with the new and modern machinery which we have installed justify the statement that the coming year will find us prepared to furnish the Best Facings and Supplies with the Most Efficient Service.

THE S. OBERMAYER CO.

WAREHOUSES
Chicago
Pittsburgh
Newark, N. J.
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FACTORIES
Chicago
Cincinnati
Rillton, Pa.

EVERYTHING YOU NEED IN YOUR FOUNDRY

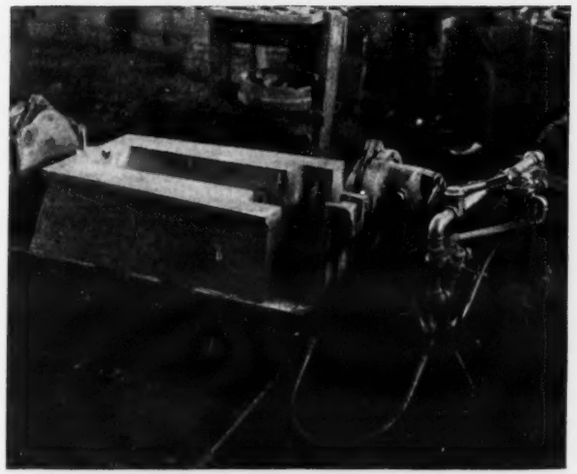
Write or phone nearest office

ESTABLISHED 1874

OSBORN

Great Lakes Foundry Co.,
Port Huron, Mich.

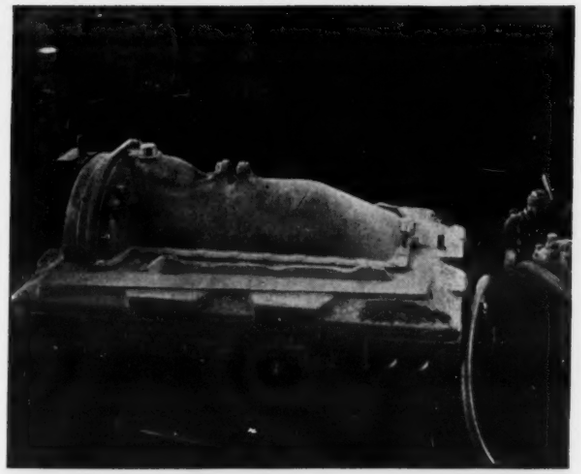
Tractor Castings



The above floor in the plant of the Great Lakes Foundry Co., Port Huron, Mich., shows part of a day's production of tractor oil pan castings which are made on two types of Osborn machines. A No. 404 Direct Draw Roll-Over Machine being used for making the drag half of the mould and a No. 450 Jolt Stripper making the cope half of the mould.

The view at the left shows the pattern mounting on the No. 404 Roller-Over Jolt machine which makes the drags. At the right is shown the pattern mounting on the No. 450 Jolt Stripper which makes the copes.

Our engineers will be pleased to study your foundry problems and give you the full benefit of their experience in foundry practice and equipment. Their suggestions have enabled many to increase production and quality of castings produced. Their suggestions may be just as valuable to you. This Osborn service puts you under no obligation.



1920 Condensed Catalogue sent on request

Osborn Roll-Over Jolt Machines

Made Regularly in the Following Sizes:

	Maximum Over-all Flask Capacity	
No. 400		24" x 24"
No. 402	" "	36" x 36"
No. 403	" "	40" x 44"
No. 403W	" "	40" x 52"
No. 404	" "	52" x 54"
No. 405	" "	60" x 64"
No. 406	" "	60" x 78"

Some Osborn Moulding Machine Advantages:

1. Insure rapid production
2. Lower direct moulding cost
3. Accelerate Delivery
4. Effect saving in material
5. Lower overhead per ton
6. Reduce grinding
7. Lessen pattern repairs
8. Relieve labor shortage

Osborn Jolt Stripping Machines

Made Regularly in the Following Sizes:

	Maximum Over-all Flask Capacity	
No. 404S		27" x 50"
No. 405S	" "	29" x 57"
No. 405LS	" "	29" x 60"
No. 406S	" "	42" x 75"
No. 448	" "	18" x 18"
No. 449	" "	21" x 22"
No. 449L	" "	20" x 29"
No. 450	" "	19" x 36"
No. 450W	" "	26" x 36"
No. 450M	" "	26" x 42"
No. 451S	" "	28" x 40"

THE OSBORN MANUFACTURING COMPANY

INCORPORATED

NEW YORK — *Main Office and Factory* — SAN FRANCISCO

5401 Hamilton Avenue, Cleveland, Ohio

FOREIGN REPRESENTATIVES

Allied Machinery Co. de France
19 Rue de Rocroy
Paris, France

J. W. Jackman & Co., Ltd.
Caxton House, S. W. 1,
London, Eng.

Horne Company, Ltd.
6 Takiyama-Cho, Kyobashi-Ku,
Tokyo, Japan

E. Isbecque & Cie.
36 Rue Otlet
Brussels, Belgium

Allied Machinery Co. d'Italia
40 Corso Dante
Torino, Italy

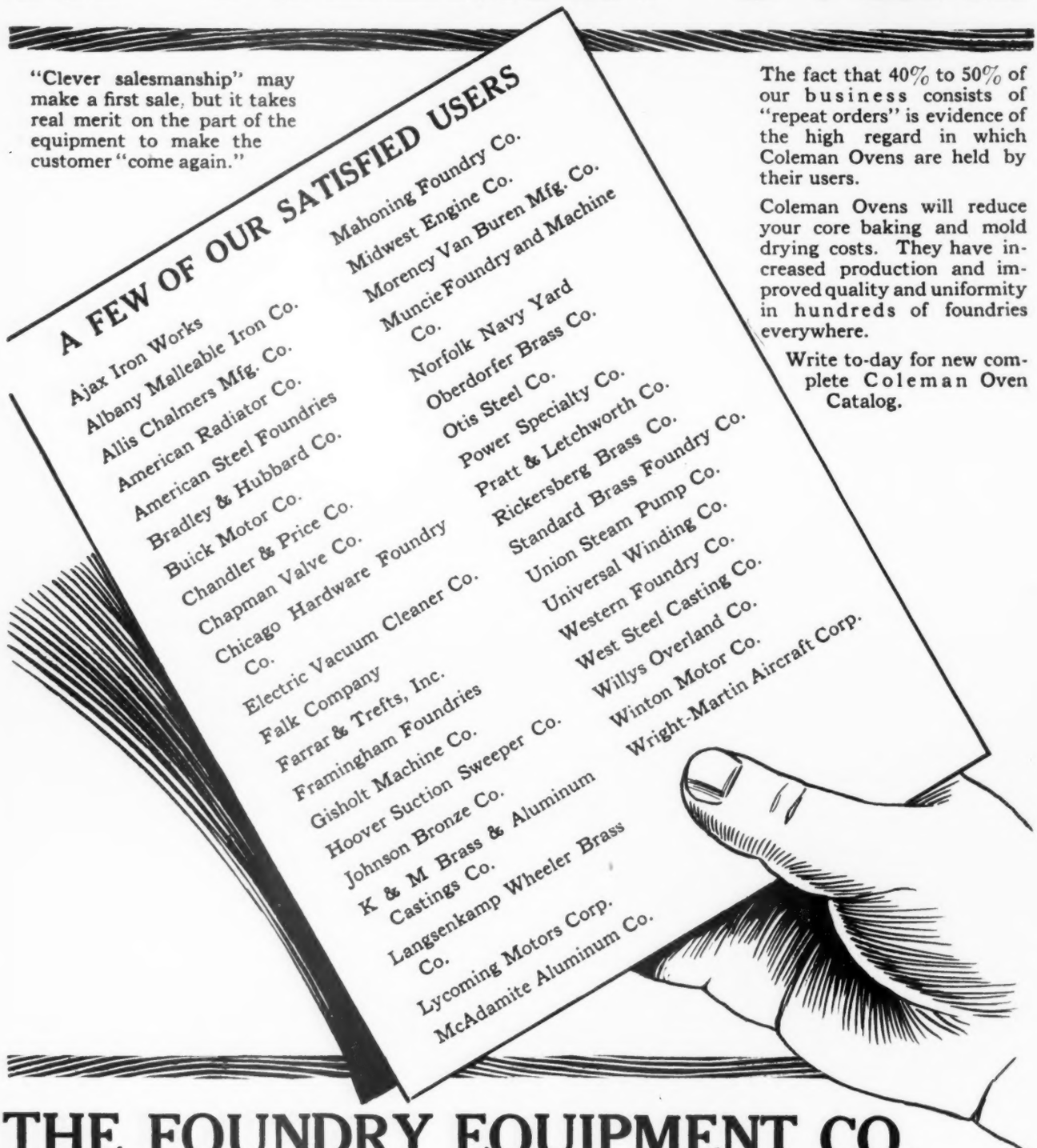
"Repeaters" for COLEMAN OVENS

"Clever salesmanship" may make a first sale, but it takes real merit on the part of the equipment to make the customer "come again."

The fact that 40% to 50% of our business consists of "repeat orders" is evidence of the high regard in which Coleman Ovens are held by their users.

Coleman Ovens will reduce your core baking and mold drying costs. They have increased production and improved quality and uniformity in hundreds of foundries everywhere.

Write to-day for new complete Coleman Oven Catalog.



THE FOUNDRY EQUIPMENT CO.

ENGINEERS
1831 Columbus Road

MANUFACTURERS
CLEVELAND, OHIO

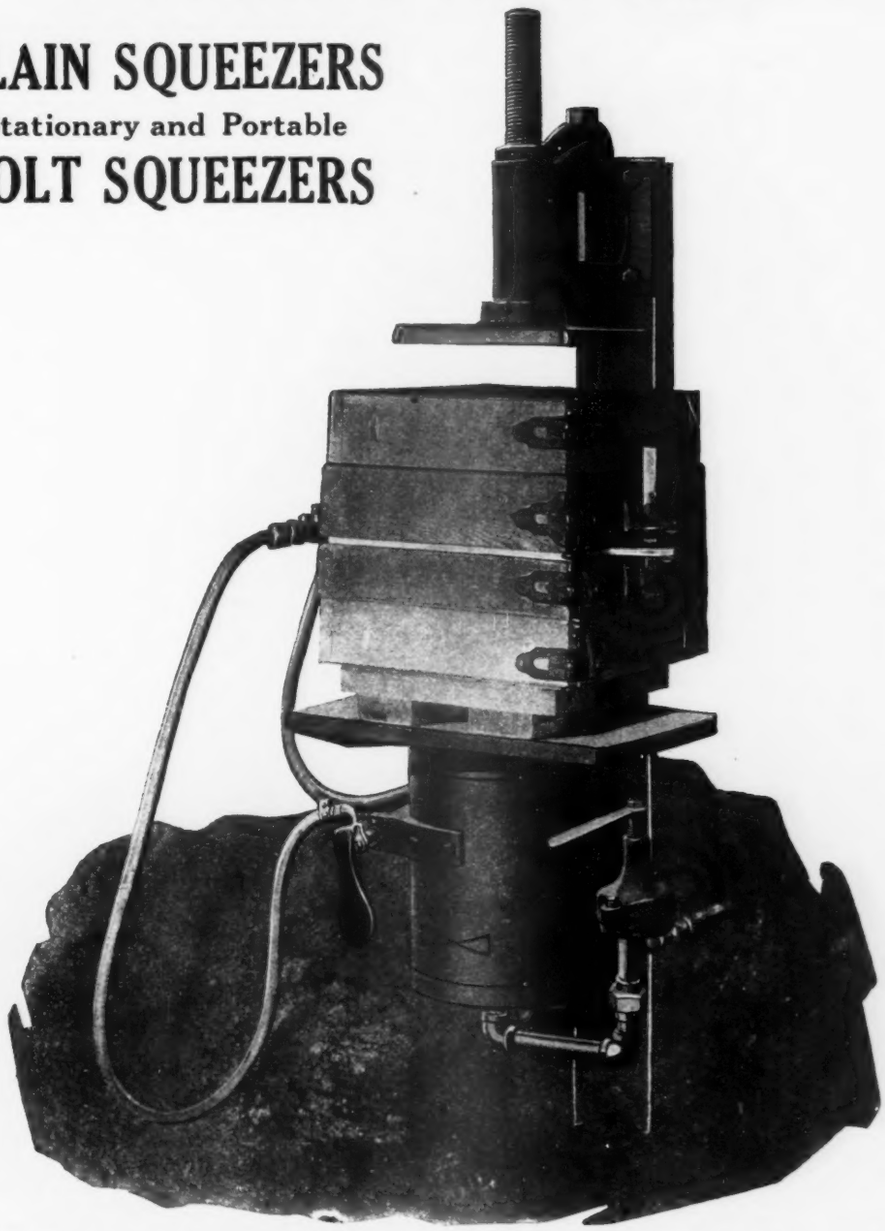
Rapid Molding Machines

"Fastest in the World"

PLAIN SQUEEZERS

Stationary and Portable

JOLT SQUEEZERS



RAPID Machines enabled their users to fill orders when deliveries were imperative, and RAPIDS are making profits for them now under competitive conditions. Let us tell you what the RAPID Machines can do for you.

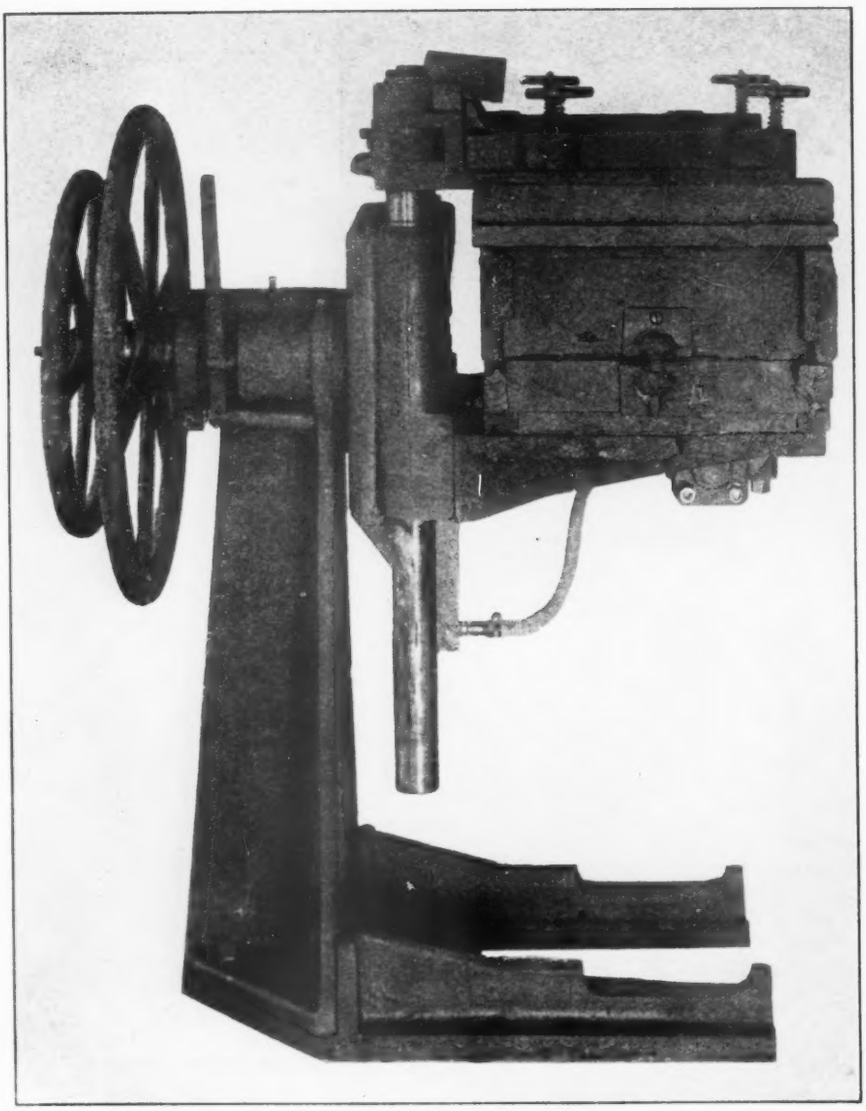
Write for Catalog No. 20.

FEDERAL MALLEABLE COMPANY

WEST ALLIS TRADE MARK WISCONSIN

GRIMES

Hand-Rammed Roll Over Machine



The Machine that Reduces the High Cost of Molding and Core Making

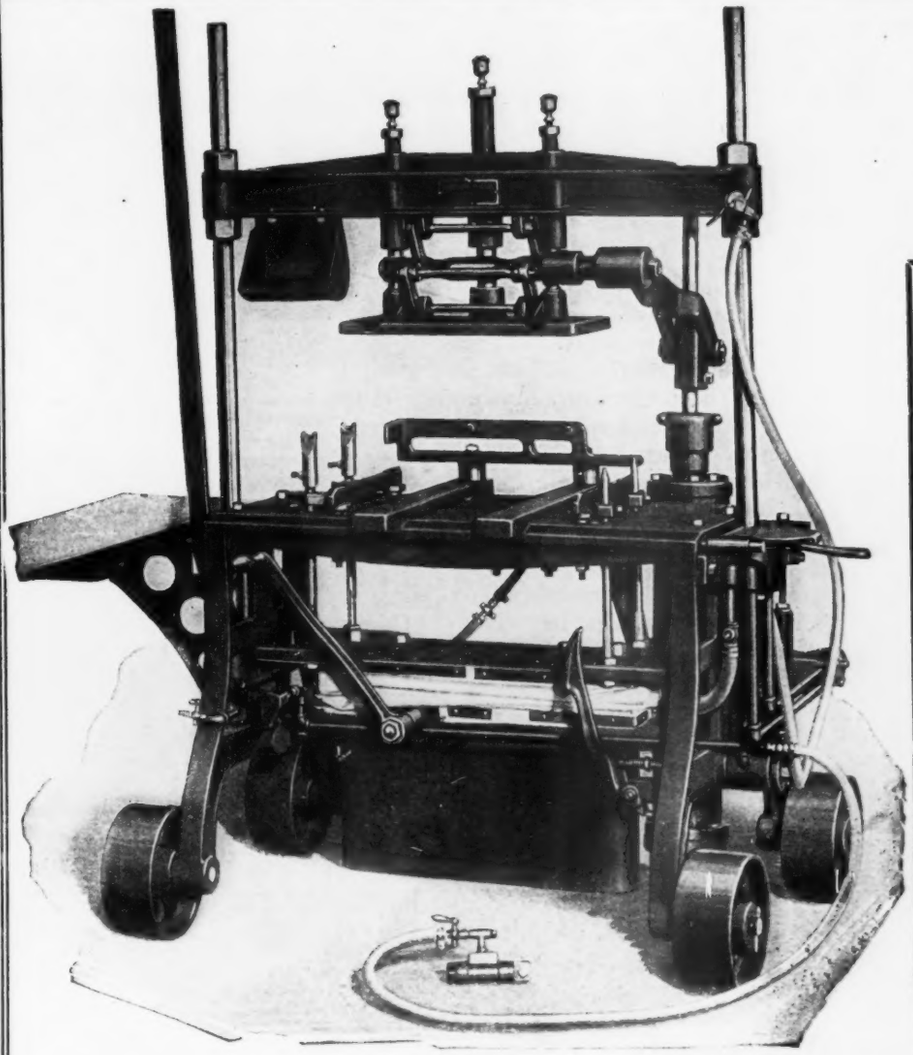
The patterns or core boxes can be changed in one minute making it the best machine for short as well as long orders.

Install Grimes machines and make the work easier for the men.

Grimes Molding Machine Co.

Formerly Midland Machine Co.

5738 Hastings Street, Detroit, Michigan



Model "E" Features

8 Reasons

1. It uses either Split Patterns or Match Plates.
2. It squeezes all Molds exactly alike, regardless of air pressure.
3. Cope rolls back out of the way. Cores are set and Mold closed right on machine, without lifting off Cope.
4. It makes quick changes possible, from one style Pattern to another.
5. It is quickly adjusted to different size Flasks.
6. It is equipped with "Berkshire" pneumatic Vibrators for any style Pattern.
7. Pattern Drawing Device so simplifies its operation, that unskilled labor can easily draw the most difficult Pattern.
8. It can be operated by hand as well as by air.

Model "E" is made in both portable and stationary types. It is equipped with the well known Berkshire Vibrator.

You See This Model—*Everywhere*

In both large and small foundries the Berkshire Model "E" Air Squeezer is found to be a conspicuous part of the standard equipment.

It is a leader in the economical production of small castings everywhere.

Eight reasons for its popularity are listed on this page. Be familiar with these peak points of the Model "E".

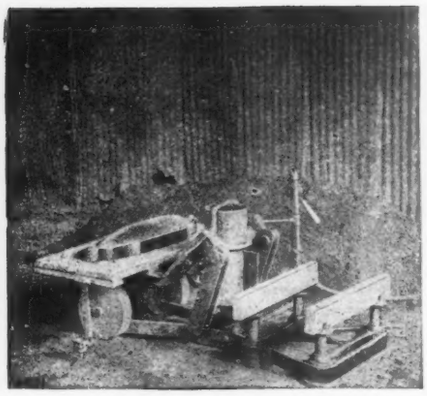
Foundries still using hand methods of molding will be interested to know how this machine will increase their production and at the same time reduce their operating costs. *Write for details.*

The Berkshire Manufacturing Co.
Cleveland, Ohio

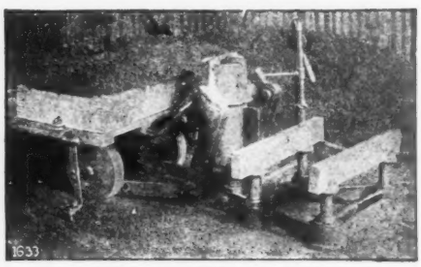
Foreign Representatives JOHN MACDONALD & CO. **Pollokshaws, Glasgow, Scotland**

BERKSHIRE

The Farwell Pneumatic Jolting and Roll-Over Molding Machine



Pattern in position ready to start molding.



Flask filled ready to jolt.

Jolting—Solid wheels resting on planks imbedded in floor serve as anvils.

Rolling over—Bottom board secured by adjustable hinged clamps.

This machine is controlled entirely by air, and requires but one man to operate it. It combines the features of jolting, rolling the mold over, drawing the pattern and rapping same meanwhile with an Adams Pneumatic Rapper, all of the operations being handled by one large air cylinder.

This machine overcomes many of the objections that have heretofore been brought up against the roll-over type of molding machine. One of the greatest of these is the difficulty encountered in rolling the mold over and drawing the pattern without cracking the mold. This is due to unevenness of the bottom board, and the trouble is eliminated only by use of our self-adjusting plungers, which allow for any inequality, and are firmly clamped by means of a single lever, which is operated by the molder's foot, while his hand is still upon the air valve controlling the movements of the machine.

The accompanying illustrations show the operation of making a drag on this machine, and demonstrate the simplicity of the operation.

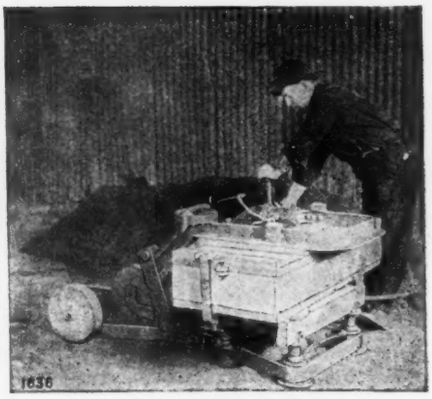
This machine is made in two sizes, to handle molds up to 750 pounds in weight.

Write for Catalogue No. 151

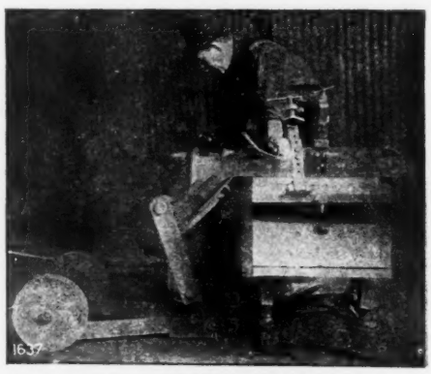
The Adams Company

Established 1883

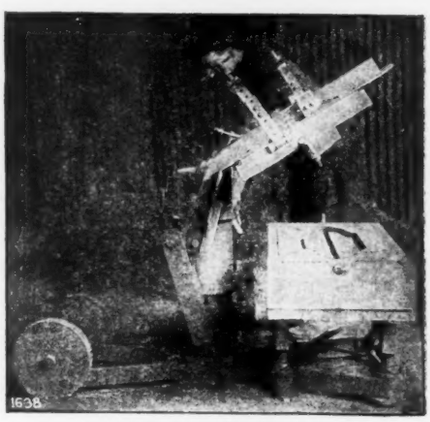
175 Foster St. Dubuque, Iowa



Molder clamps supporting plungers—Lever operated with left foot.



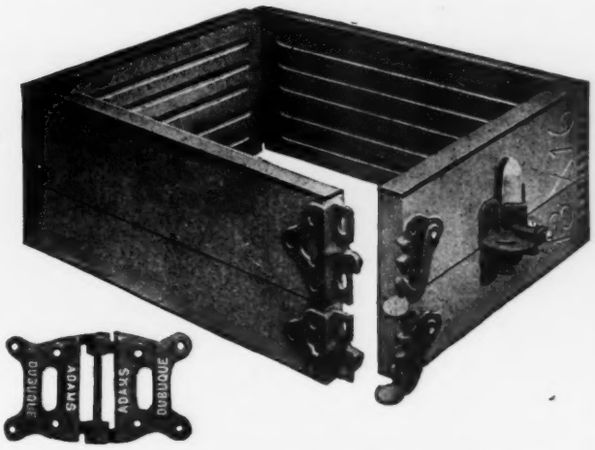
Pattern drawn straight as slowly as desired while vibrated by Rapper.



Rolling back to original position after pattern is drawn.

As arm passes center, air pressure is exhausted.

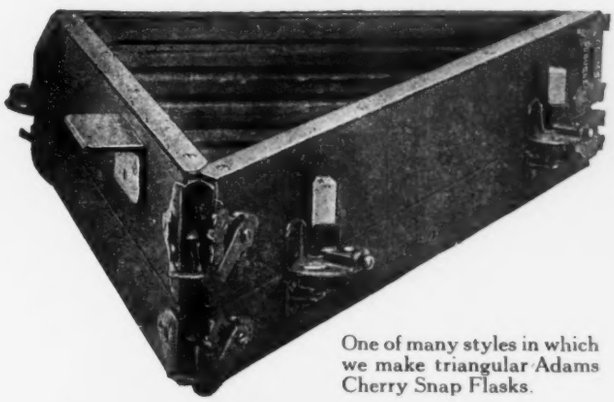
FLASKS



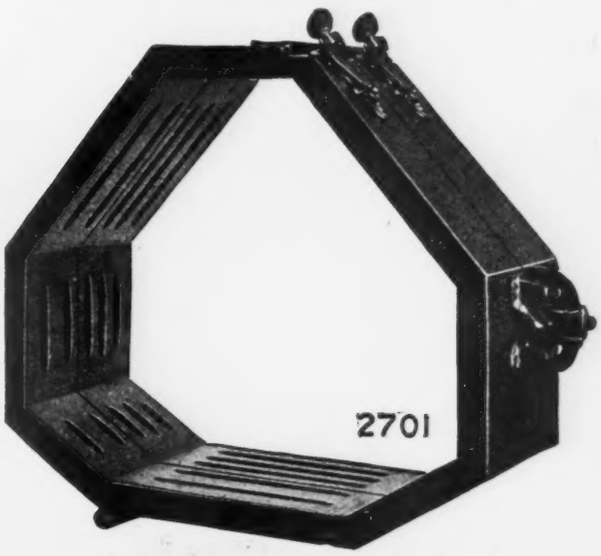
Rectangular Adams Cherry Snap Flasks made in any size—either straight or tapered.

Irregular partings made to your template or drawings.

JACKETS

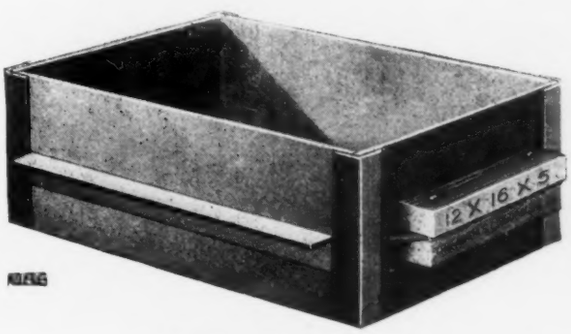


One of many styles in which we make triangular Adams Cherry Snap Flasks.



A shape that saves handling a lot of sand.

Round Adams Cherry Snap Flasks are glued up in laminations and turned accurately to size.



Adams Steel Jacket

BANDS

A Flask that you would have trouble getting made elsewhere.

Adams Steel Band

The Adams Company Est. 1883

170 Foster Street
DUBUQUE, IOWA, U.S.A.

TRUSCON FOUNDRY FLASKS

Truscon Flask for Fordson Tractor Front Cover
16¾" x 19¾"
cope 6½" x 5½", drag 10"

Just as made-to-measure clothes better fit the man, so TRUSCON Flasks, designed for the job, better fit the job.

TRUSCON Flasks are designed to have ample strength without excess weight. The thickness of the shell varies from ⅛" to ¼" depending upon the size of the flask, the height of the

TRUSCON STEEL CO. TRUSCON PRESSED STEEL

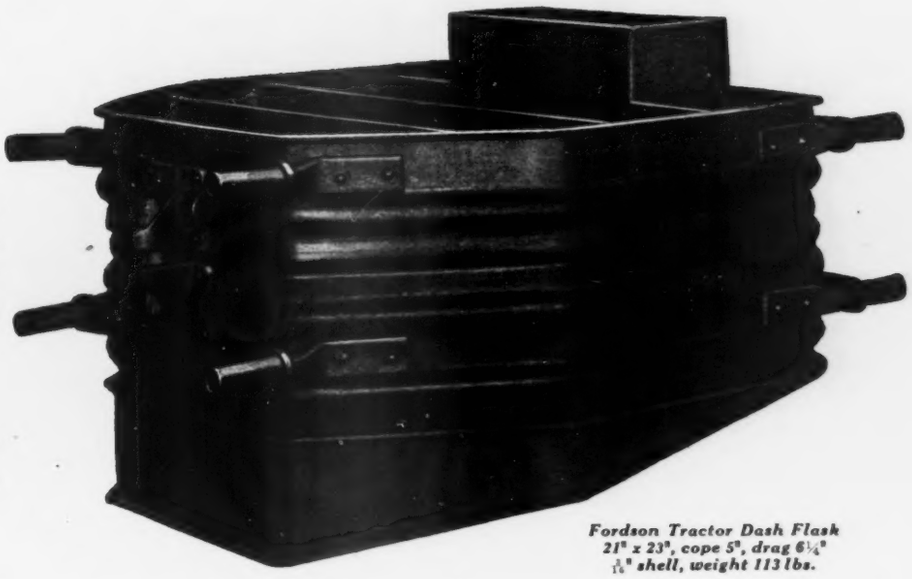
Truscon Flask for Eastern Malleable Iron Company, Troy, N. Y.
24" x 57", 12" cope, 7" drag

DESIGNED FOR THE JOB

sections and the kind of metal to be poured.

Not only is the weight of the flask correctly determined but by peculiarities of design the amount of sand required is decreased and kept at a minimum.

Economy is built into TRUSCON Flasks when they are designed.



Fordson Tractor Dash Flask
21" x 23", cope 5", drag 6¼"
⅛" shell, weight 113 lbs.

Special Construction of Truscon Flasks

Truscon Flasks are formed of special Truscon Alloy Steel plates. The deep ribs and broad flanges give to the steel shell exceptional strength and rigidity. Each rib and flange runs full depth around the corners and reinforces the steel to withstand all strains and stresses to which Flasks are liable on the foundry floor.

Truscon cross bars are formed from steel plates also. They are furnished bolted, welded or riveted to the walls of the Flask as desired.

Truscon Flask for Samson Tractor Co.
Janesville, Wis.
19 x 26", 11" cope, 4" drag
¼" stock

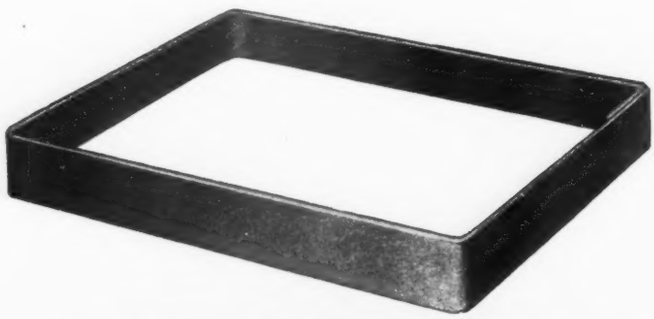
Pressed Steel Dept.

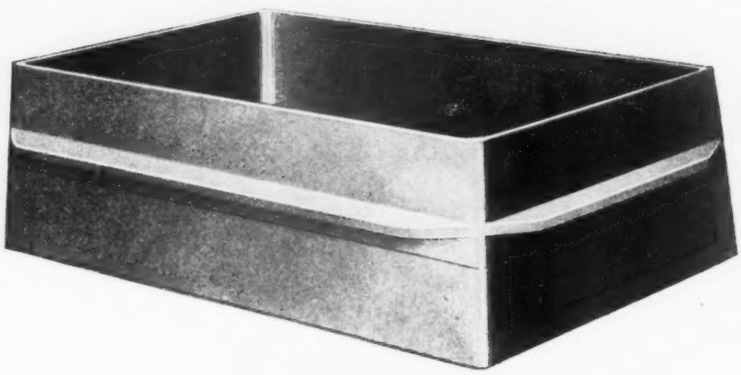
Truscon Steel Co.

Youngstown, Ohio

PECK

STEEL BANDS AND JACKETS





100% Success in the foundry is attained only after much thought, costly experiments and endless worry.

But why do all this costly experimenting etc., when others have already run the gauntlet? The Peck System represents the survival of the fittest. It has always come out on top wherever it was subjected to side by side tests with other equipment. Now, it is regarded as the standard equipment for all foundries, large or small.

Peck Slip Jackets are unusually rigid and durable. They will withstand the roughest usage without losing their trueness of shape—in spite of which, they are light, and easy to place without liability of damaging the molds.

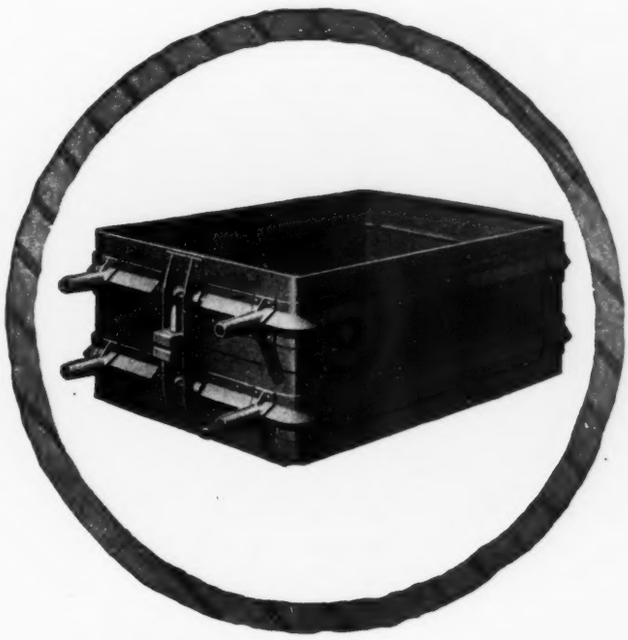
Peck Snap Flask Bands have also long been extensively used by foundries throughout the country. Their reasonable cost combined with their high efficiency, should be enough to get them into *every* foundry.

If *you* are not using Peck Equipment; why not give us a chance to show you its many advantages?

PECK IRON AND STEEL WORKS

VICKSBURG, MICH.

Why Over 3000 of the 5500 U. S. Foundries Use Sterling Flasks



Sterling Rolled Steel Flask LL, suitable for either bench, floor or machine moulding.

Sterling Flasks are always custom made to meet particular needs of every type of work. There are no standard sizes. Write to us outlining your requirements.

The Only Rolled Steel Flask

This almost universal adoption of Sterling Flasks is largely due to their *rolled* steel construction which makes a flask 50 per cent lighter than cast iron and one which can't burn nor break.

Rolled steel is the ideal flask material, combining great strength and rigidity with light weight.

And only rolled steel permits of a narrow sand retaining flange—this is why you can ram the sand even and close to the parting with Sterlings.

The Solid Center Rib

Only Sterling *Rolled* Steel Flasks have this great feature. It means rigidity—great resistance to torsional strains and stresses. It brings these advantages without increasing weight.

This solid center rib is an integral part of Sterling Flasks.

The Angle Reinforcement

Large size flasks need additional reinforcement. This fact everyone concedes. Even the Sterling Solid Center Rib is not enough for the big ones. But with the angle reinforcement—ah! that's another story.

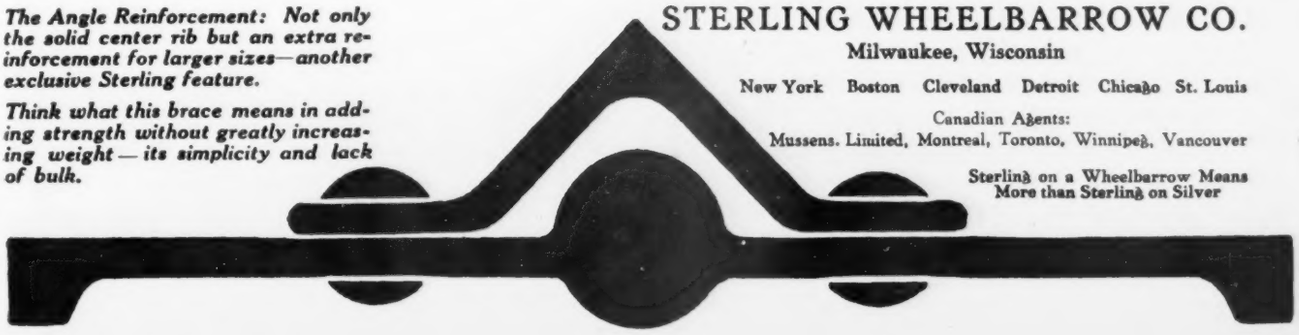
There's no job too tough for it. And note this great advantage—it does its job of reinforcing without adding great bulk or weight. A big factor in ease of handling.

Have you gone to the bottom of this flask business? Do you know that most foundries find it far cheaper to buy Sterlings than to make their own wooden or cast iron flasks?

Why not consult with us? No obligation. If you are one of the few who cannot profitably employ Sterlings, we'll tell you quick enough. But if you belong to the great majority who can save with Sterlings, you should know it. Write us today.

The Angle Reinforcement: Not only the solid center rib but an extra reinforcement for larger sizes—another exclusive Sterling feature.

Think what this brace means in adding strength without greatly increasing weight—its simplicity and lack of bulk.



STERLING WHEELBARROW CO.

Milwaukee, Wisconsin

New York Boston Cleveland Detroit Chicago St. Louis

Canadian Agents:
Mussens, Limited, Montreal, Toronto, Winnipeg, Vancouver

Sterling on a Wheelbarrow Means More than Sterling on Silver

The nearest to perfection

Diamond Clamp & Flask Co.

38-40 N. 14th Street RICHMOND, INDIANA

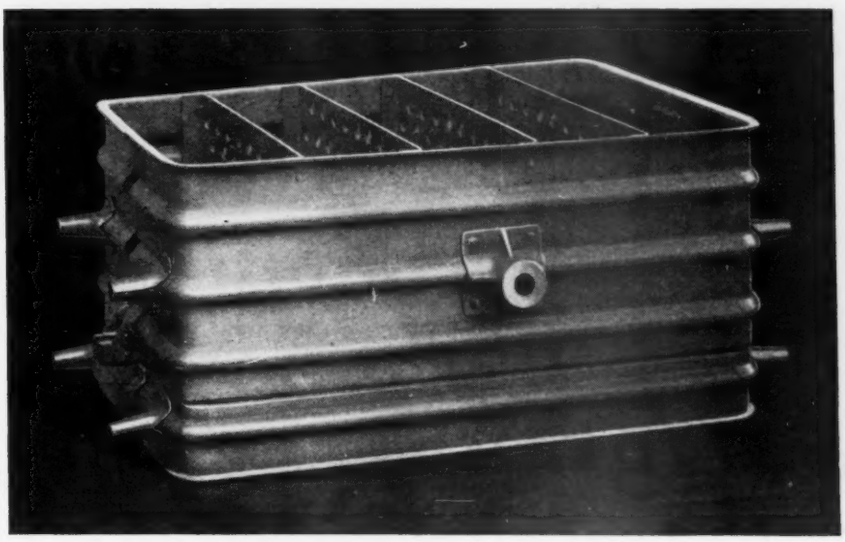
UNION METAL

PRESSED STEEL FOUNDRY EQUIPMENT

Union Metal Pressed Steel Crank Case Flask

18" wide one end, 23" wide other end, 35" long.

Patented March 20, 1920



Main body pressed from heavy gauge copper bearing steel.

Corrugations passing completely around flask give great strength without use of rivets or external reinforcements.

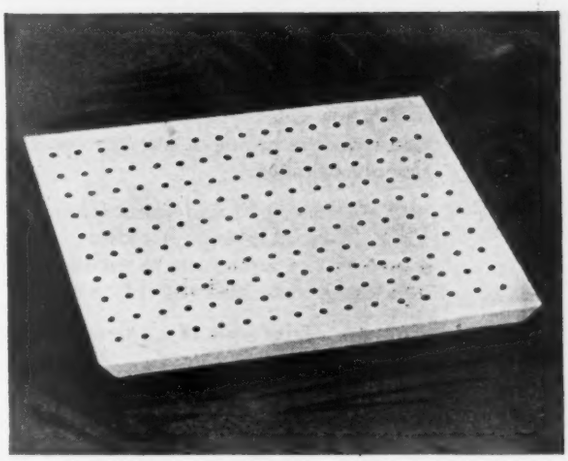
Flasks furnished in different sizes and shapes with or without steel cope bars.

Union Metal Pressed Steel Core Plate

Patented April 13, 1920

Lengthwise edges are thrown down on heavy punch presses, thus forming a rigid structural plate and eliminating long riveted angles.

Furnished in all sizes either plain or perforated.



LET US QUOTE YOU ON YOUR PRESENT REQUIREMENTS

The Union Metal Manufacturing Co.
Canton, Ohio

Received Yours?

If not write for it

Not merely a catalog, but also an attractive treatise on the subject of Quality. From every page, from cover to cover, quality shines out to guide the progressive foundryman to greater production through the channels of efficiency and supreme quality products.

Every page contains valuable information concerning unsurpassed production that should be in your foundry, saving time, labor and money. Your castings can be no better than the materials used to make them; your workmen can be no more efficient than their tools.

Only the highest quality products find their way through our organization into the hands of our customers. Our products are carefully selected and thoroly reliable.

We carry Philadelphia Chaplets; Wyoming "Red Edge" Shovels; Buffalo Vent Wax; Dobson Molders Tools; Osborn Brushes, and other quality products too numerous to mention here. Our catalog gives complete information and prices, and should be on the desk of every buyer of foundry equipment.

We carry nails of all descriptions.

Before you forget, write for *your* catalog.

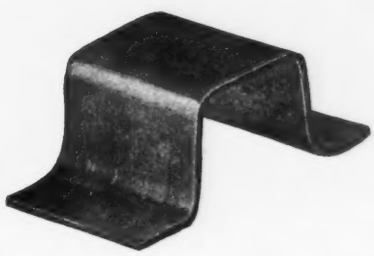
Liberty Supply Company, Inc.

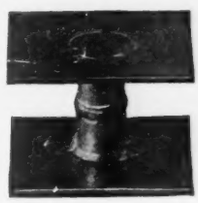
Ridge Avenue and Cresson Street
Philadelphia

Philadelphia Chaplets

for

High Grade Work

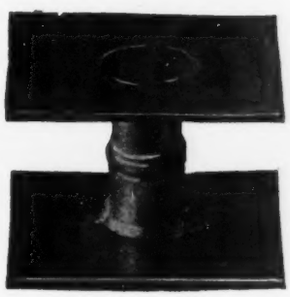




Any Style You Want

The demand for high grade chaplets is daily increasing. Inferior chaplets have resulted in so much trouble and such heavy losses that most foundrymen will not put up with them. *Philadelphia Chaplets* have made a reputation for themselves that places them in great demand—because we are strictly Chaplet Specialists—our entire plant is devoted to their production. We carry *most* sizes and styles in stock—but can fill your requirements for anything—nothing is too large, or nothing too small.

See the illustrations: note the heavy shoulders and collars that prevent the chaplets from collapsing.



Philadelphia Chaplet & Mfg. Co.

School Lane and Ridge Ave.

PHILADELPHIA, PA.

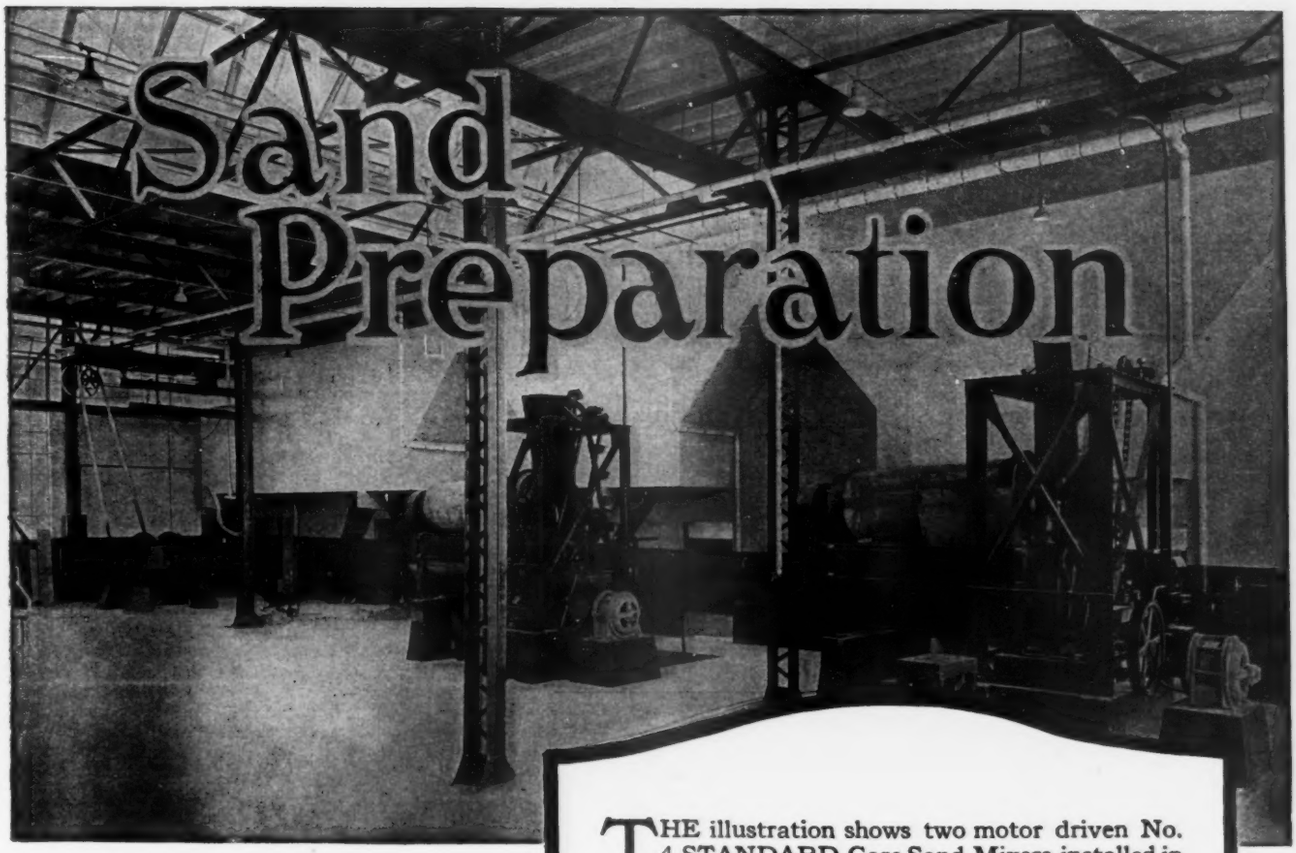
Speed—More Speed! All through the progressive foundry, every possible improvement is used to increase production. From the cleaning of flasks and spraying of cores, through every department, to the painting of the finished casting BRANFORD PNEUMATIC CLEANERS AND SPRAYERS render wonderfully efficient and speedy service. They clean or spray in any position or place that can be reached by jet—which includes places that it would be impossible to reach by any other method.

The Branford Pneumatic Cleaner and Sprayer can be used as a liquid sprayer or as a plain air jet without changing any connections, and is quickly and easily controlled by a quick operating hand valve. Price $3.00 F. O. B. Branford, Conn.

The "Branford" Vibrator, another speed producer, is made entirely of hardened and ground steel. It is quick acting, durable, powerful in action and economical in air consumption. Made in ⅛" sizes from ⅜" to 2".

MALLEABLE IRON FITTINGS CO.
BRANFORD, CONN., U. S. A.

Distributors "Branford" Vibrators and Accessories: Buckeye Products Co., Cincinnati; Coates & Zarling, Milwaukee; Combined Supply & Equipment Co., Buffalo; Dayton Molding Machine Co., Dayton; Donald Mfg. & Supply Co., Milwaukee; Dominion Foundry Supply Co., Montreal, Que., and Toronto, Ont.; Foundrymens Supply Co., Milwaukee; Hotchkiss & Co., Inc., Waterbury, Conn.; Kelly & Co., Inc., New York; Federal Steel Co., Detroit; New York Sand & Facing Co., Brooklyn, N. Y.; J. Jacob Shannon Co., Philadelphia; Snow & Galgiani, San Francisco; Whitehead Bros. Co., Providence, Buffalo; E. J. Woodison Co., Boston, St. Louis, Cleveland, Buffalo, New York, Detroit, Philadelphia, Pa., Milwaukee, Wis., Seattle, Wash., Toronto, Ont., Canada, Montreal, Que., Windsor, Ont.; Alexander Haigh, 200 Devonshire St., Boston, Mass., Philadelphia, Milwaukee, Seattle, Toronto, Ont.; F. B. Stevens, Detroit, Mich., New Haven, Conn., Indianapolis, Ind., Erie, Pa., and Windsor, Ont.; Canada; Industrial Trade Corporation, First National Bank Building, Williamsport, Pa.



THE illustration shows two motor driven No. 4 STANDARD Core Sand Mixers installed in a very modern up-to-date Automobile Foundry where proper preparation of the sand is one of the most important items connected with the making of castings.

Probably more castings are scrapped because of improper sand preparation than from any other known cause.

Modern foundrymen are protecting their production against this evil by installing the STANDARD SAND MIXER.

The "STANDARD" screens, tempers and mixes in one continuous process and with only one handling.

When a batch of sand is prepared, the discharge gate underneath the body is opened and the batch dropped into a wheelbarrow or car.

From 3 to 5 minutes mixing by the Standard Mixer will uniformly blend and temper Core and Facing Sand with any tempering liquid or binding compounds now in use.

Furnished with either belt or motor drive. Built in five sizes ranging from 1 to 60 tons per hour.

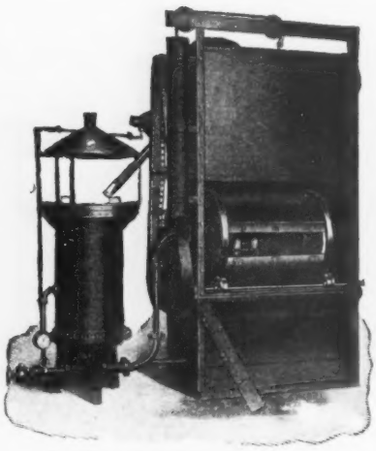
Write for Catalog

The Standard Sand & Machine Co.

Cleveland, Ohio, U. S. A.

DUSTLESS SELF-CONTAINED HOEVEL SANDBLAST AUTOMATIC MACHINES

Patented

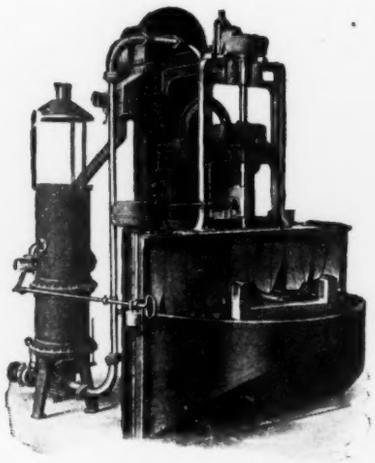


Revolving Barrel Sandblast Machine

Barrel revolves slowly, thereby turning pieces over. Cleaning done by sandblast only, not by tumbling. These barrel machines have been in continuous operation for eight years.

We furnish every type of sandblast and allied equipment for all purposes. We use the pressure system to insure economy and efficiency. Our long experience in building sandblast machines insures satisfaction.

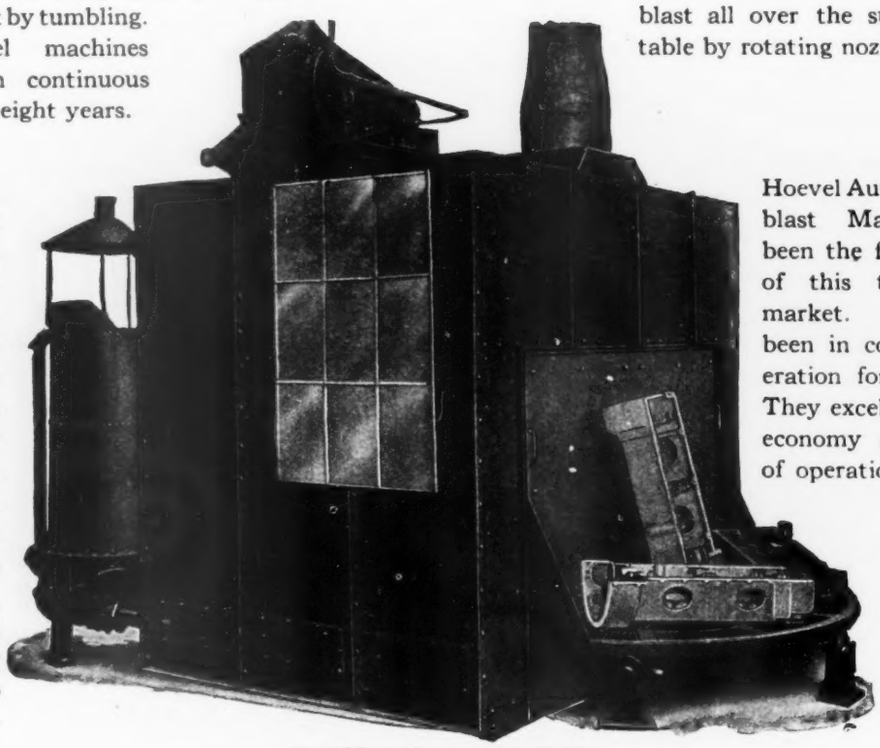
Patented



Rotary Table Sandblast Machine

Table rotates continuously at slow speed. Even distribution of sandblast all over the surface of the table by rotating nozzles.

Our patented air inlet and exhaust slots secure efficient ventilation of the sandblast rooms. We equip our sandblast rooms with sandblast table, turntable, track, overhead trolley or plain floor, to suit every requirement.



Sandblast Room with Table

Hoevel Automatic Sandblast Machines have been the first machines of this type in the market. They have been in continuous operation for eight years. They excel in efficiency, economy and low cost of operation.

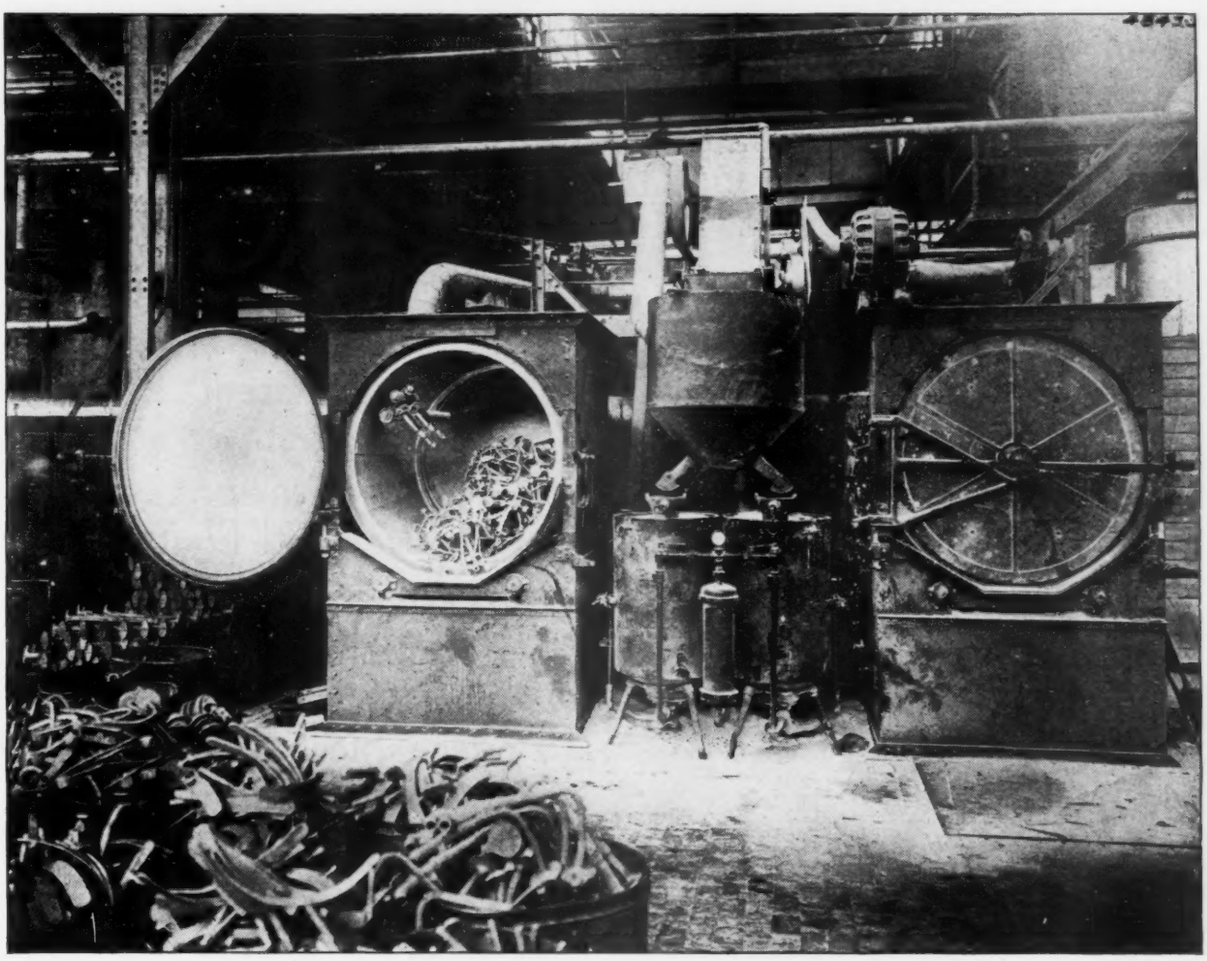
Hoevel Manufacturing Corporation

CONTROLLED BY

L. O. Koven & Brother, 156 Ogden Ave., Jersey City, N. J.

Cleveland Office: 503 American Trust Building

ATTENTION
MALLEABLE FOUNDRYMEN!



Double 50" x 48" P. E. S. Barrel

at

NATIONAL MALLEABLE CASTINGS CO.
CLEVELAND, OHIO

CLEVELAND, OHIO
First Double Unit Ordered March 15, 1919

Second Double Unit Ordered July 21, 1919

These barrels are thoroughly cleaning 2200 lbs. of malleable castings in 20 minutes.

The reciprocating arm which carries the nozzles assures them cleaning a greater tonnage per day than can be accomplished with any other sand blast barrel.

Bulletin No. 87 describes fully this wonderful barrel

CHICAGO, ILL.
Third Double Unit Ordered October 1, 1919

Fourth Double Unit Ordered October 15, 1919

"Repeat orders mean satisfied customers"

MOTT SAND BLAST MFG. CO., Inc.

CHICAGO, ILL.
24 So. Clinton St.

BROOKLYN, N. Y.
2 FROST ST.

Difficult Jobs Made Easy

No matter what sort of equipment you have—whether the most strictly up-to-date, or a little more or less ancient—**Portage Sands** will make your work easier. They are the favorite foundry sands of most molders and sand-blasters. Taken from Nature's choicest sand deposits, they are improved by us to the utmost of human skill, to meet your various requirements.

Portage Steel Molding Sand averages over 98 per cent Silica.

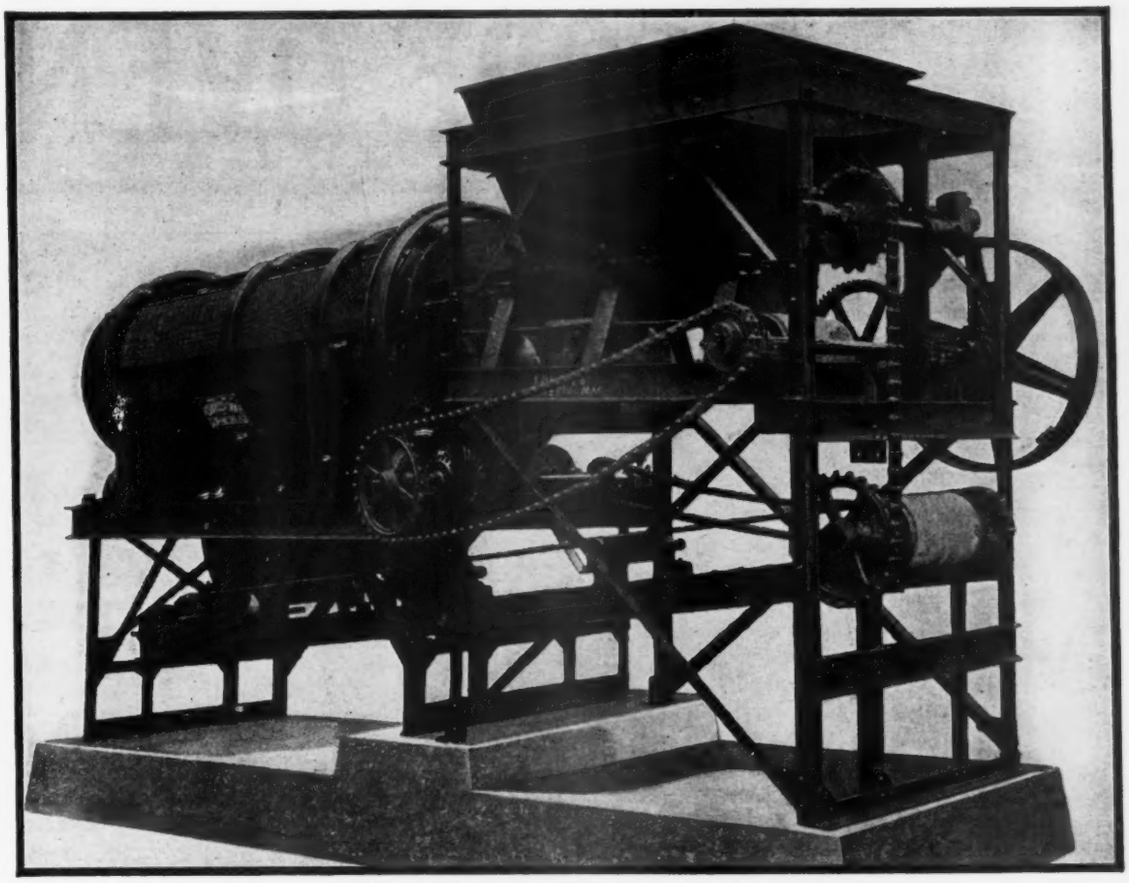
Portage Sand Blast Sands are clean, hard, sharp and uniform.

Then why not—

Start your castings right with Portage Steel Molding Sand—and **finish** them right with Portage Sand Blast Sands.

THE PORTAGE SILICA COMPANY
YOUNGSTOWN, OHIO

PORTAGE SANDS



Unit for screening and reclaiming burnt sand

MECHANICAL sand-handling equipment and mechanical carrying equipment for carrying molds and cores and castings will speed up production, will save floor space, will produce lower unit costs, and will improve working conditions.

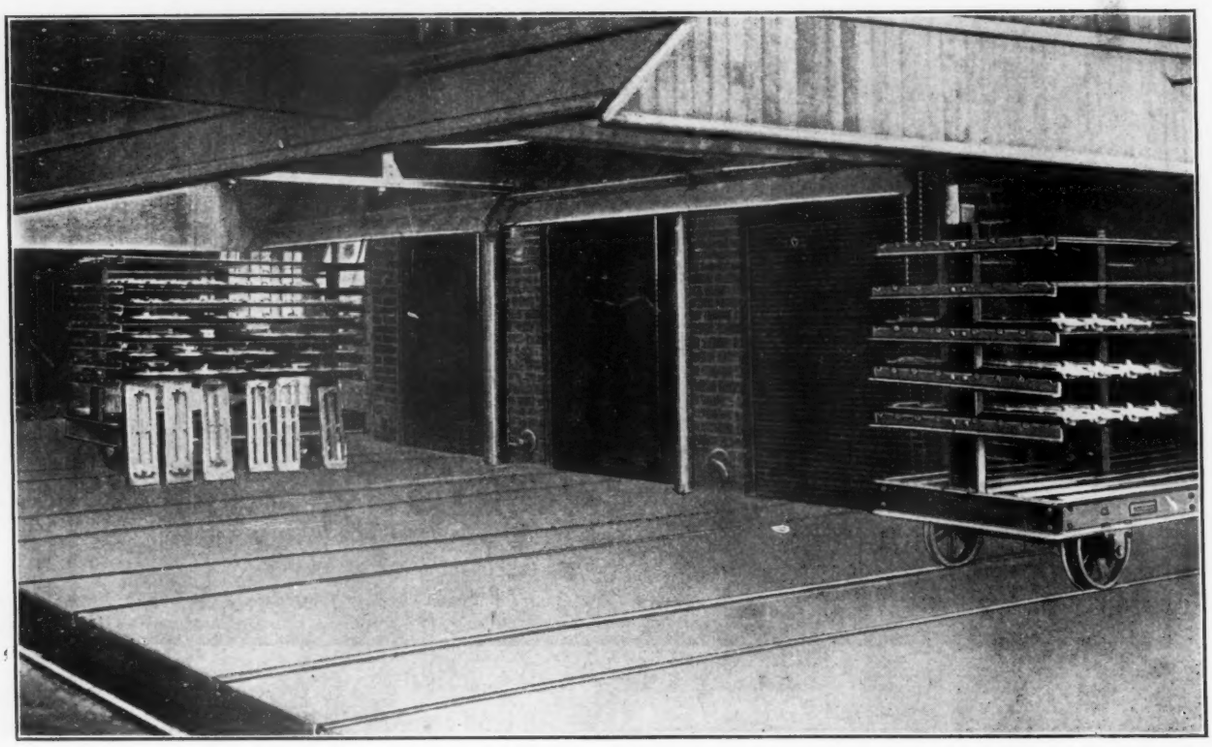
Ample proof of this statement, in the form of hundreds of successful installations, is available for anyone who is interested in making his foundry more profitable, more productive and more human.

THE C. O. BARTLETT & SNOW CO.

Main Office and Works: Cleveland, O.

Builders of foundry sand-handling equipment and conveyors and elevators for carrying and lifting molds, cores, and castings.

SLY CORE OVENS



Installation of a SLY Core Oven with Core Cars and Transfer Track

CAR OVENS
RACK OVENS
DRAWER OVENS

CORE CARS
CORE RACKS
CORE SHELVES

All our Core Ovens are designed and built to meet the special requirements of the individual Purchaser

Mold Drying and Ladle Drying Ovens

SLY FOUNDRY EQUIPMENT "UP-TO-DATE"

Other Sly Products

Steel Tumbling Mills	Sand Blast Rotary Tables
Iron Cinder Mills	Cupolas
Brass Cinder Mills	Core Ovens
Resin Mills	Core Oven Equipment
Sand Blast Rooms	Core Sand Reclaimers
Sand Blast Cabinets	Exhaust Fans
Dust Arresters	

Write for Catalog

THE W. W. SLY MFG. CO.
CLEVELAND, OHIO

SIMPSON
INTENSIVE FOUNDRY
MIXER

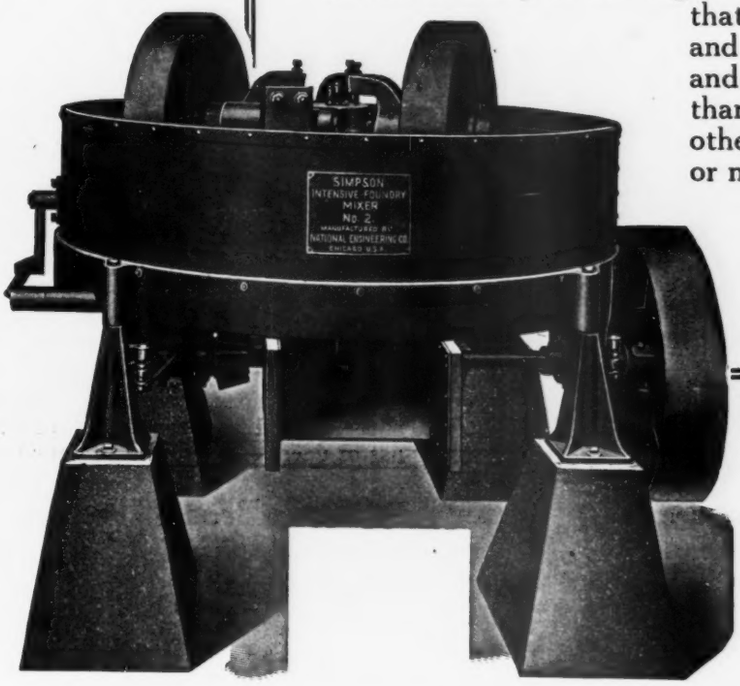
Efficient and economical for all kinds of foundry sand mixtures.

Lowers Foundry Costs

The Simpson Sand Mixer is solving the problem of lowering sand mixing costs as well as maintaining the highest quality of mix.

Approximately 30% less new sand is required for mixtures of equal strength. The mixing can be done with 50-75% less labor, depending on the size and type of machines used.

Simpson Sand Mixers have proven, by actual service in many of the largest foundries in America, that they blend facing and core mixtures better and more economically than can be done in any other way, either by hand or mechanically.



"The Product of a Practical Foundryman"

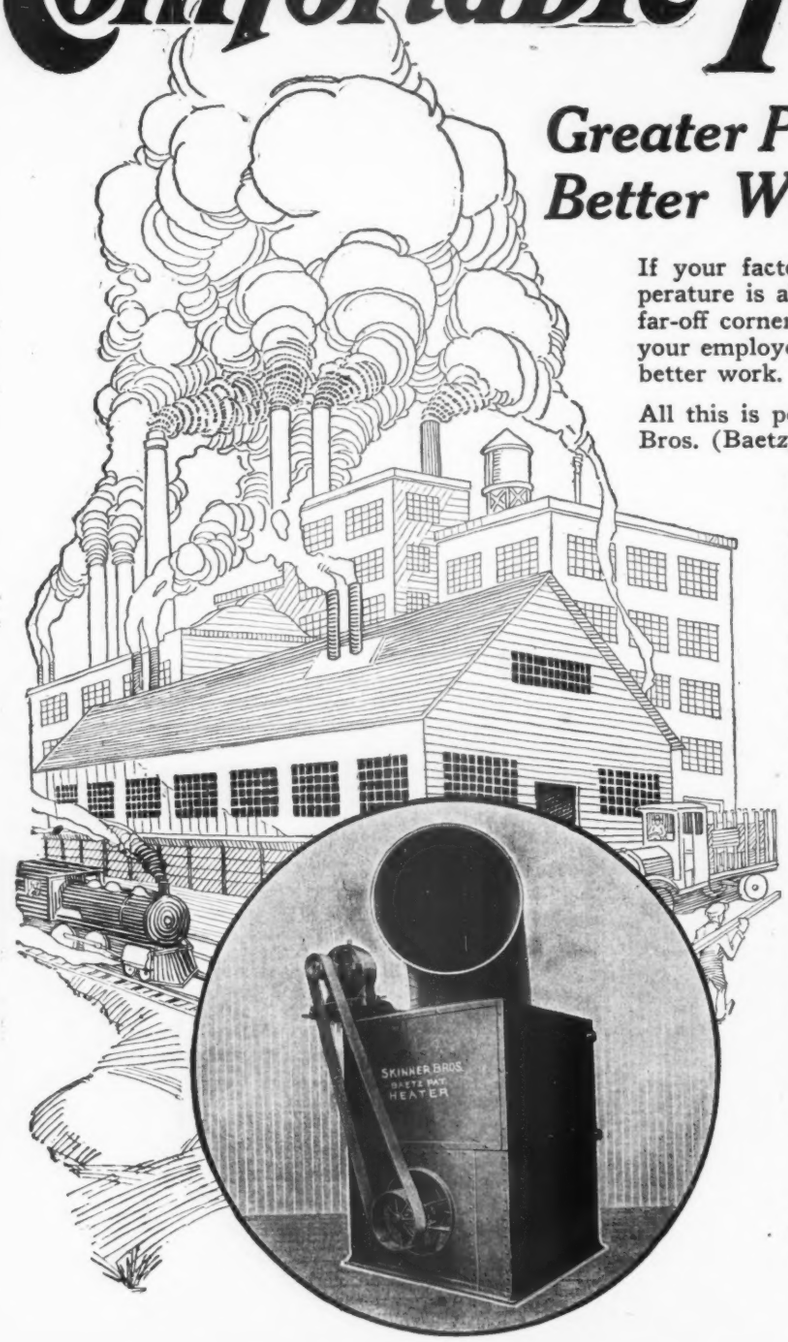
SEND FOR PAMPHLET NO. 50 AND LIST OF MANY USERS

NATIONAL ENGINEERING COMPANY

549 WEST WASHINGTON BOULEVARD

CHICAGO, ILL.

Comfortable Factories



Greater Production Follows Better Working Conditions

If your factory is comfortably heated — if the temperature is always uniform — if it is just as warm in far-off corners as in the center of the building — *then* your employees will naturally be able to do more and better work.

All this is possible if you are equipped with Skinner Bros. (Baetz Patent) Heaters

Skinner Bros. Heaters operate without a complicated system of exterior pipes or ducts for air distribution—cool air at the floor level (or from outside) is drawn into the unit by a powerful fan-wheel, heated during its upward passage around a series of steam-heated coils or a heated firing chamber, and then distributed through directing elbows to the far corners of the open space. This mild, gentle air circulation causes no drafts or air blasts.

Economical to Install and Maintain

Installation cost is 15 to 50% lower than any other type; maintenance cost is equally low. The Skinner Unit is portable; requires no special foundation; can be easily moved and relocated by common labor, ready to operate, within a few hours.

Guaranteed— Get Further Facts

Skinner performance is positively guaranteed; send now for Bulletin No. 50 and list of users — it will be to your benefit.

Skinner Bros. Mfg. Co.
1424 S. Vandeventer Ave.
St. Louis, Mo.

SKINNER BROS.

BAETZ PATENT HEATING SYSTEM

Skinner Brothers Mfg. Co., 1424 S. Vandeventer Avenue, St. Louis, Mo.

Please send us your illustrated booklet and full particulars on Skinner Bros. Heating Systems.

Firm.....

Address.....

Attention Mr.....

Can you use steam?.....

For what purpose building used—

.....

GARDNER

Pumps - Governors - Compressors

TESTS: Before any product leaves our plant it is thoroughly tested *under actual working conditions.*

These tests are made by workmen of the longest experience — men who have been building Gardner machinery all their lives and know when it is right. It takes time and costs money: Often a compressor or pump will be on the testing floor for days: But when the test is completed, we *know* it is built right.

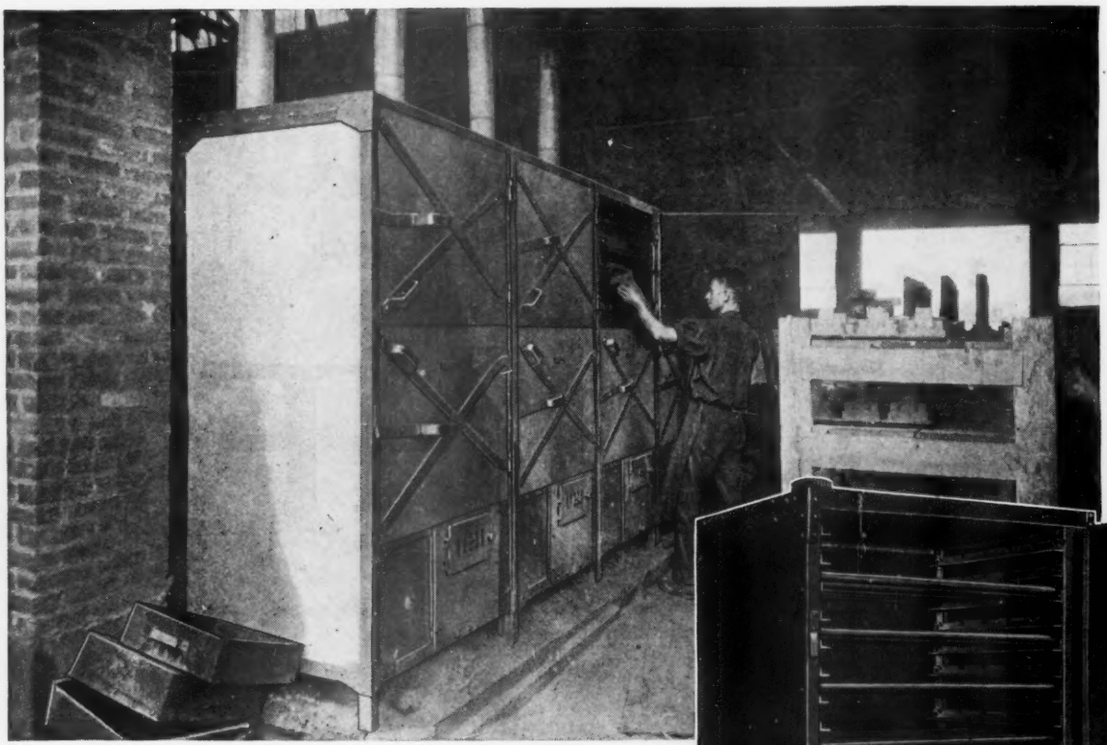
Gardner Pumps, Compressors and Governors have been standard equipment in good plants for years. Careful testing, which insures the product you buy being up to Gardner standard, is just one reason.

No matter what your requirements, there is a Gardner just right for your work. And every Gardner product is built up to the high quality standard established by the founders of this business 62 years ago. Separate bulletins describing our products to you on request.

GARDNER GOVERNOR COMPANY
Quincy, Illinois

Pumps---Governors---Compressors

Chicago	New York	Philadelphia	San Francisco	Los Angeles
Fisher Bldg.	Singer Bldg.	604 Arch St.	505 Howard St.	409 E. Third St.



An Installation of Swartwout Portables in a Big Eastern Foundry.

This installation will keep a dozen core-makers hustling.

This battery of four Swartwout Portables occupies only 36 sq. ft. of floor space, yet with the shelves spaced at every support (at 3" centers) they have a combined shelf capacity of 56,800 square inches.

And they are the fastest of Swartwout fast bakers. These four ovens will bake small stock cores as fast as a gang of a dozen men can make them—and need less than 100 pounds of coke a day to do it.

It's the Swartwout Insulated Steel Walls that conserve fuel—the heat is kept inside where it does the work—not lost thru absorption and radiation.

Swartwout Catalog on request

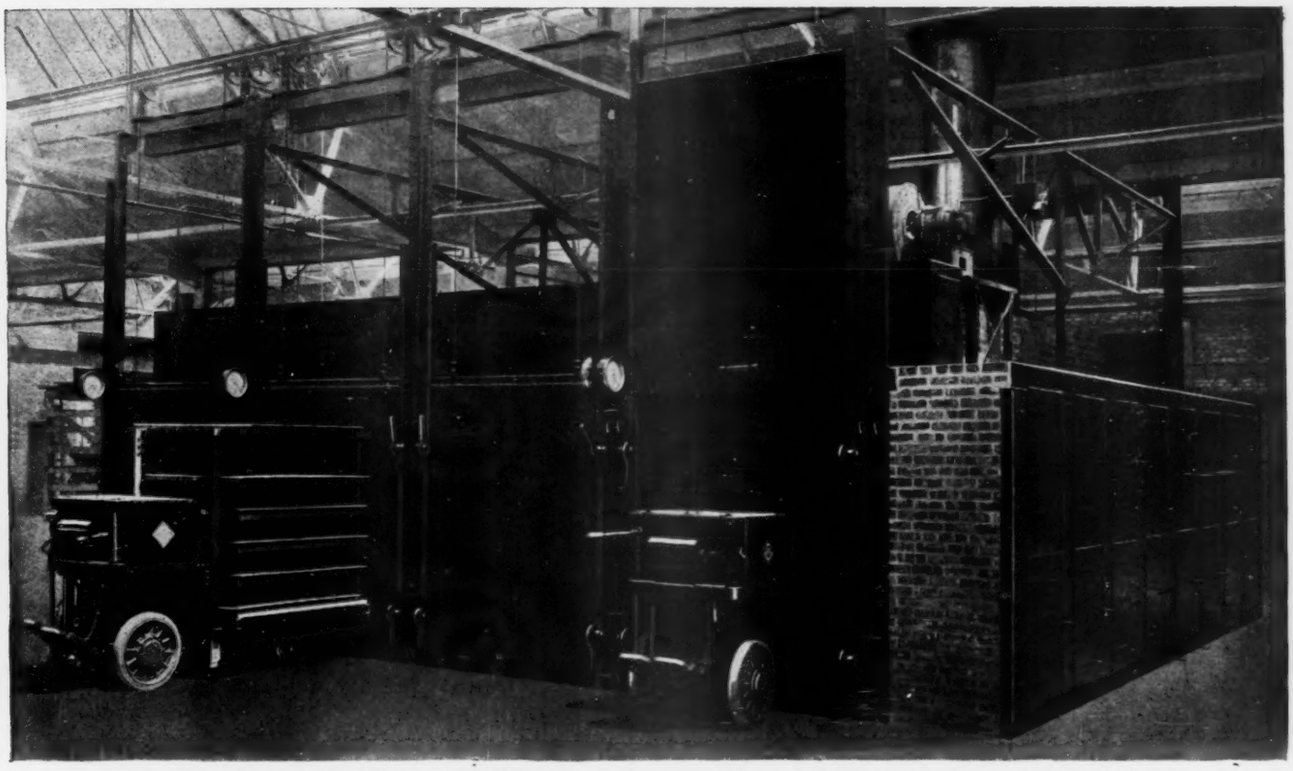
THE SWARTWOUT SPECIALTY DIVISION OF THE OHIO BODY & BLOWER CO.
CLEVELAND

Swartwout Portable Core Ovens

3 ft. sq. x 6 ft.-6" height. Shelves are 29" wide by 31" deep and are adjustable at 3" intervals. Pipe for 6 shelves is furnished. The fire box is designed so that coal, coke, gas or oil can be used. Also built as a portable Electric Core Oven.

625° inside and the outside is not hot enough to scorch the hand.

Swartwout CORE OVENS



Battery of Patented Rack Type and Shelf Core Ovens, Showing Racks and Electric Lift Trucks at the Ryan-Bohn Foundry Company, Lansing, Mich.

Specified By Leading Foundries

In outfitting a new foundry or changing over an old one, there is real satisfaction in ordering equipment that you know is pre-eminent in its field and dependable from every standpoint of production and service. The selection of Holcroft equipment eliminates all chance and uncertainty, and one installation will establish our reputation with you and bring us repeat orders as your plant grows in size. Everywhere our ovens and furnaces give the highest satisfaction, and from our many hundreds of clients we print almost at random such representative firms as these:

Adirondack Steel Foundries Corp.
American Blower Company
American Brake Shoe & Foundry Co.
American Car & Foundry Company
American Locomotive Works
American Radiator Company
Bayonne Steel Casting Company
Bohn, The Chas. B., Foundry Co.
Bridgeport Brass Company
Buhl Malleable Company
Cadillac Motor Car Company
Canton Sheet Steel Company
Chester Steel Casting Company
Continental Heater Corporation
Detroit Steel Casting Company
Fairbanks, Morse & Company
General Fire Extinguisher Co.
Hamilton Foundry & Machine Co.
International Harvester Co.
J. I. Case Plow Works Company
Kelsey Wheel Company
Lockport Foundries Corp.
Maxwell Motor Company, Inc.
Michigan Malleable Iron Co.
Minneapolis Steel & Machinery Co.
Monitor Stove Company
Motor Castings Company
Nash Motors Company
Novo Engine Company
Packard Motor Car Company
Penn Seaboard Steel Corp.
Ryan-Bohn Foundry Company
Saginaw Products Company
Saginaw Malleable Iron Co.
Samson Tractor Company
Sowers Manufacturing Co.
Superior Foundry Company
Symington Co., The T. H.
Verona Steel Castings Co.
Westinghouse Electric & Mfg. Co.
Whitehead & Kales Iron Works
Wilson Foundry & Machine Co.

Open Hearth and Malleable Air Furnaces, Core, Mold and Annealing Ovens

HOLCROFT & COMPANY

CONTRACTING ENGINEERS

BOOK BUILDING DETROIT, MICH.

YOUR FOUNDRY NEEDS THIS

KNICKERBOCKER COLLECTOR

The baseball pitcher may "dust 'em off" and the housemaid may do likewise—but there *would be* no dust lying around if *The Morse "Rarefied" Dust Collector* were on the job.

By the dust you have in your foundry you can estimate your lost efficiency and impaired equipment.

There is no other device used in connection with an exhaust system, that separates the dust with the degree of consistency and reliability that the MORSE RAREFIED DUST COLLECTOR accomplishes. Let us send you our catalog and list of installations.

THE KNICKERBOCKER CO

516 LIBERTY STREET-JACKSON MICHIGAN

The Hour Before Pouring

(After "The Night Before Christmas")

'Twas an hour before pouring, and all thru the shop
Not a Moulder was working, not even a Wop.
The ladles were placed near the spout with delight,
In hopes that the iron would come down before night.
The Moulders were resting, the meek and the bold,
Awaiting the iron to pour into the mold;
And the Cupola Tender and Foreman with fears,
Peeked in at the iron and coke nearby the Tuyeres—
When up on the Charging Floor there rose such a clatter
They sprang up the stairs to see what was the matter;
Away to the Blower Room they flew like the deuce,
Tore open the door and switched off the juice,
The light, on the junk and the dirt gathered there,
Gave a feeling of death—destruction—despair;
When, what to their wondering eyes should appear,
But the wreck of their Fan used for many a year,
With bearing cut out from high speed and dirt,
They knew in a moment the blades must be hurt
The Foreman then whistled, and shouted for men,
To patch up the fan for five days or ten:
"O'Brien! Gallinsky! Yens Yensen and Sam!
MacPherson! Kaczmarek! Larson! and Lamb
Get hammers, and wrenches, and babbitt galore,
Now fix up this fan till we get a Roots Blower!"
As the rainbow that follows the shower in spring
Brings joy and delight to each living thing,
So the Roots Engineer telephoned the next day,
And found them a Blower to ship right away.
And then in a twinkling the word went around
That things would improve from roof to the ground.
Plans were devised for setting the Blower
In a special location on the Mezzanine floor,
The room was sealed tight from the weather and dust,
To protect the machinery from all wear and rust;
The drive from the motor was made direct,
So the volume delivered was surely correct.
Large diameter pipe for the blast, best of all
Clean air brought from outside through a duct in the wall;
The men worked like beavers without a complaint,
Made an excellent job from concrete to paint,
The first heat was planned for the first of December,
It's a date that the men will always remember,
For instead of an hour to bring down first metal,
As required by the fan when it worked in fine fettle,
The Roots cut this time to ten minutes or less,
And the increase in tonnage even beat the best guess,
The jubilant moulders have more time to work,
They're paid by the mold so they don't want to shirk;
Everyone in the plant is making more pay,
The December money made a bright Christmas Day,
They give Roots the credit for all of these joys,
The Rotary Blower is the pride of the Boys.

ROOTS

Blowers for Cupolas, Furnaces, Smelters, Agitation of Liquids, Pneumatic Conveyors, etc.

Gas Pumps for By-Product Coke Plants, Gas Works, Handling Chlorine, Sulphur Dioxide, etc.

Rotary Pumps for Wash Oils, Tar, Asphalt, Syrups, Crude Oil, Milk, Molasses, etc

Vacuum Pumps for Paper Mills, Sugar Mills, Vacuum Filtration, Priming Centrifugal Pumps, Heating Systems, etc.

The P.H.&F.M.ROOTS CO.
DEPT. 42
CONNERSVILLE, IND.
Chicago Office
122 S. Michigan Ave.
New York Office
Room 802-120 Liberty St.

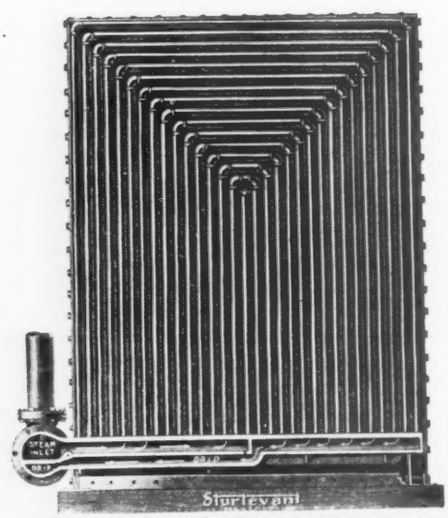
Sturtevant
REG U.S. PAT OFF.
PUTS AIR TO WORK

Heaters to Warm Any Foundry —Fans to Keep The Air Clear

It makes no difference what your particular heating and ventilating problem is, there is a Sturtevant Equipment to take care of your needs.

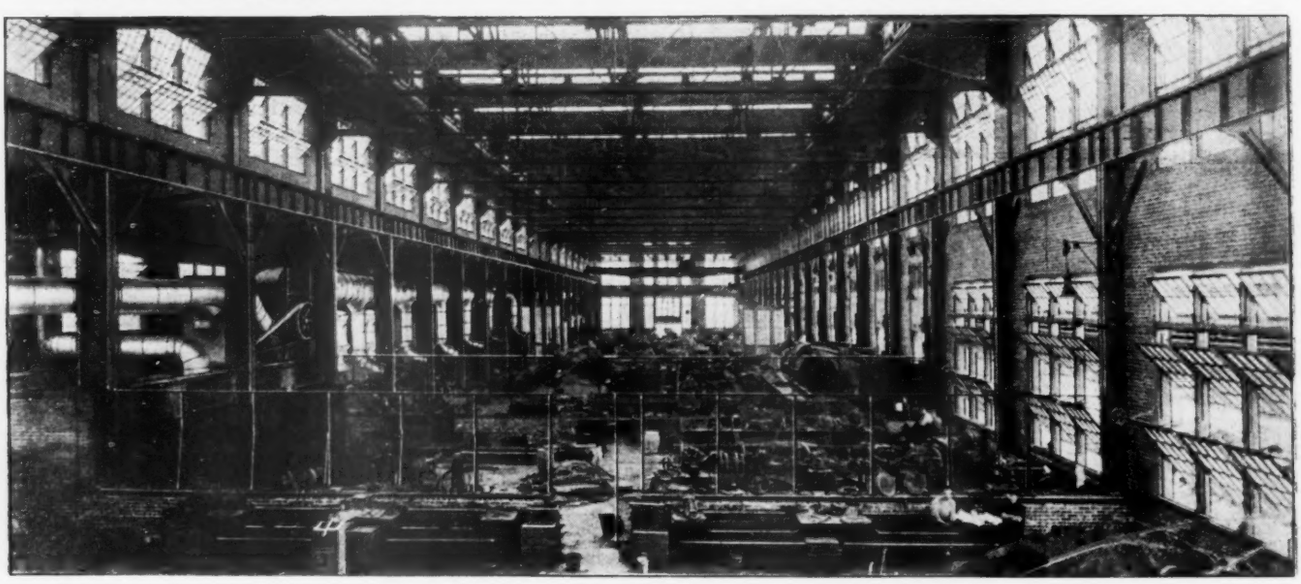
Years of intimate contact with every conceivable foundry heating and ventilating requirement coupled with practical applications of Sturtevant engineering and Sturtevant apparatus places us in a position to give you an absolutely unbiased recommendation for your foundry.

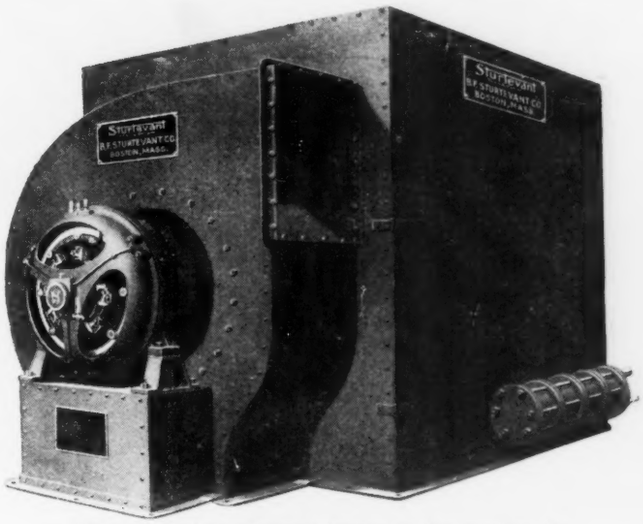
We are not limited to the manufacture of one particular type of heater or fan. Our aim is to furnish you an installation that harmonizes with the size of your foundry and the number of people working in it. By accomplishing this we eliminate future dis-satisfaction and retain your good will.



Sturtevant Regular Type Heater Section

A Typical Foundry Heating and Ventilating installation. Notice the fan and heater ducts are not using valuable space.





Fan and heater equipment similar to that used on the installation on the opposite page.

From the elaborate installation, as shown on the opposite page, to the simple units as shown at the right of this page your foundry falls within the range of our ability to serve you.

In the first instance every corner of your foundry is supplied with a scientifically measured amount of warm air that changes every few minutes together with a constant flow of fresh air that keeps your moulding sand free from frost and your workmen comfortable.

The unit heater arrangement is an A-1 apparatus for the solving of a simple heating problem when an extended system is not so desirable.

Remember, however, we are in a position to express an un-prejudiced opinion for you at any time. Get in touch with us before Winter is here.

Catalogs and bulletins are free for the asking. No. 2301-I will give you a good idea of Sturtevant equipment.

Unit Heater for the solution of simple heating problems.

B. F. STURTEVANT COMPANY

HYDE PARK, BOSTON, MASSACHUSETTS

AND ALL PRINCIPAL CITIES

Progressive foundries realize the benefit of forming classes among their employes to study **McLain's System** in order to develop future foundry executives.

Scientific men who possess practical knowledge, or practical men with a technical education covering their particular line, are in great demand and ***McLain men*** are a ***combination of both.***

The class at the Homer Furnace Company, Coldwater, Michigan, now has twenty-five members. The foundry manager, Mr. H. D. Keller, is desirous of educating the employes of the Furnace Company to fill many positions where executive ability is necessary.

Every foundry owner or manager should find in this example a thot well worth considering.—Firms who help to improve and broaden their employes' knowledge of foundry practice thru **McLain's System,** are building up an efficient and valuable organization for themselves.

Write For Club Rates.

McLAIN'S

803 Goldsmith Bldg.,

Knowledge is The One Big Difference Between Successful Foundry Practice and Failure!

While labor and time-saving devices are being installed by even the smallest manufacturers, how do YOU KNOW THAT YOU ARE GETTING THE MOST OUT OF WHAT YOU HAVE NOW?

Why Not Have Us Report On Your Cupola?

Coke savings—reduction of total melting time—insurance against dull iron—an improvement of your product by a reduction of pig and increase of steel scrap, are possible.

There are two ways of learning how to make *good castings* at the *lowest cost*—

Years of costly experimenting and untiring effort, or—

McLain's System

the SHORT, DIRECT, ECONOMICAL, SURE route to successful foundry practice.

Send for 32-page Synopsis.

SYSTEM, Inc.

Milwaukee, Wis.

Semi-Steel Castings have lighter section—lighter weight—and greater tensile strength than gray iron.

Scientific Mixing and Melting is the Key to better quality.

Our report on *your* cupola may give you some new ideas.

McLain's System is recognized as Standard Foundry Practice everywhere.

McLAIN'S SYSTEM, INC., 803 Goldsmith Bldg., Milwaukee, Wis.
I am interested in
STEEL
Crucible
Converter
Electric
Open Hearth
Semi-steel
Gray Iron
Cupola Practice
Name.....
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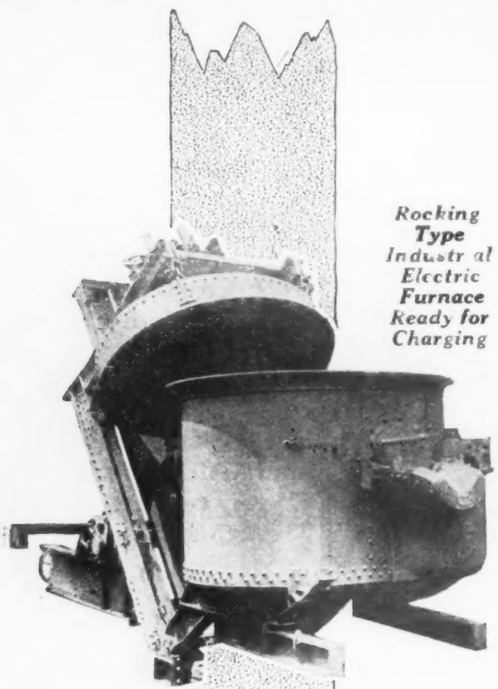
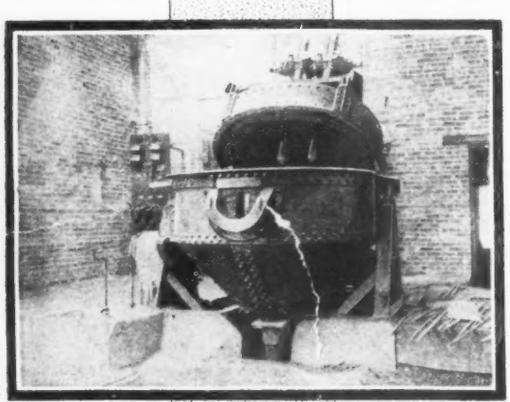
Position.....
12-15-20

Preheating for Electric Furnaces



Rocking Type Industrial Electric Furnace Ready for Charging



Industrial Electric Furnace No. 501 Ready for Charging

The advantages of the electric furnace can be retained and, at the same time, a substantial economy in heating can be effected by use of the preheating process. With this method the charge is heated to a cherry red by some outside means before the electric heating is used. At the cherry red temperature steel will not be affected by any fuel use—oil, gas, coal or coke. As an example of this economy fifteen gallons of oil used for preheating will save 200 K. W. hours of electrical energy per ton of metal melted. The preheating method will increase the capacity of the electric furnace.

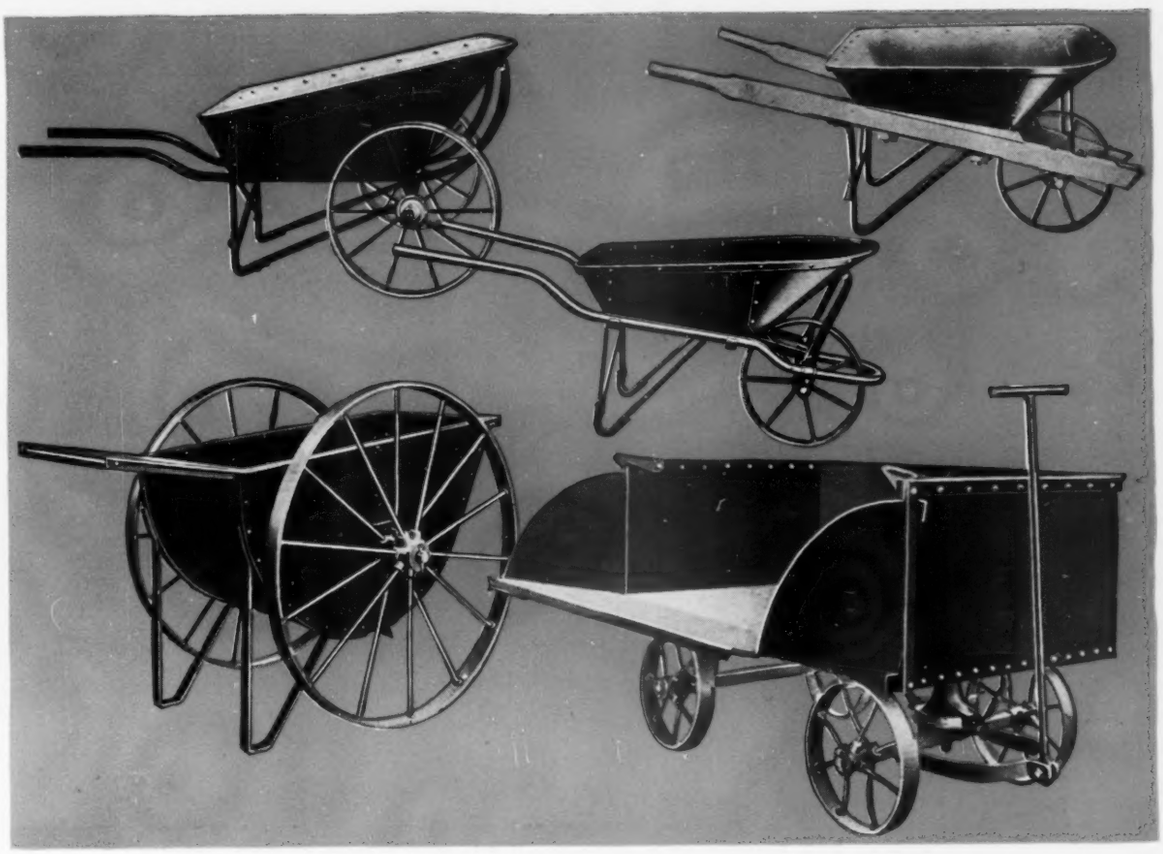
All these advantages are possible, however, only when the opening roof, doorless type electric furnace is used. With this method, the preheated charge can be taken out of the preheating furnace and dropped directly into the open electric furnace.

The upper illustration at the left shows a rocking type Industrial Electric Furnace with the roof open, ready for receiving the preheated charge. The lower illustration shows a smaller type of furnace, of one ton capacity, ready for charging. Both of these are especially well adapted for use with the preheating system. They are built with either two or three phase, two electrode, two arc systems, and with acid or basic lining.

Special illustrated folders have been prepared, which completely illustrate and describe these two furnaces in connection with the preheating system. Write for your copies.

Industrial Electric Furnace Co.
53 W. Jackson Blvd. Chicago

AKRON BARROWS
ECONOMY - QUALITY - SERVICE



"UNUSUALLY Substantial and long-lasting" is the testimony of thousands of users of Akron *quality* steel Barrows and Carts.

The continuously growing demand for these better-made conveyors indicates the one thing you, as a foundryman, are interested in—that the built-in sturdiness and service of Akron Barrows and Carts mean far greater economy in the end.

Read Other Side—

The Akron Cultivator & Mfg. Co.
AKRON, OHIO, U. S. A.

AKRON BARROWS

ECONOMY - QUALITY - SERVICE

—A Sand Cart For Bigger Loads Per Trip With Less Effort

This cart is particularly adapted for sand and small castings. Its accurate balance permits the user to convey larger loads per trip, but with less effort than would be required with the ordinary type of barrow.

There is a type of Akron Barrow for your every barrow need. One of our distributors near you will take care of your requirements promptly.

Write today for our catalog and name of distributor.

THE AKRON CULTIVATOR & MFG. CO.

Akron, Ohio, U. S. A.

than ADAMANT

FIRE BRICK CEMENT

Quite A Broad Statement

but it is only one of many such similar expressions that we receive almost daily and we want to have all Foundrymen throughout the Country just as enthusiastic. ***You*** are busy right now we know figuring how you can minimize your operating costs.

Everybody's Doing It. All Right! Let's Help Each Other

Just figure up approximately, what LININGS cost you last year. Now divide that by five—and you will know what your cost would have been, had you used ADAMANT.

Also, just for a little information, figure up what SHUTDOWNS cost you last year and divide that by five—and then multiply by four—and you'll see what you could have saved, just in shutdowns alone, had you used ADAMANT.

And now that we've set you thinking, we'll leave you to your figuring

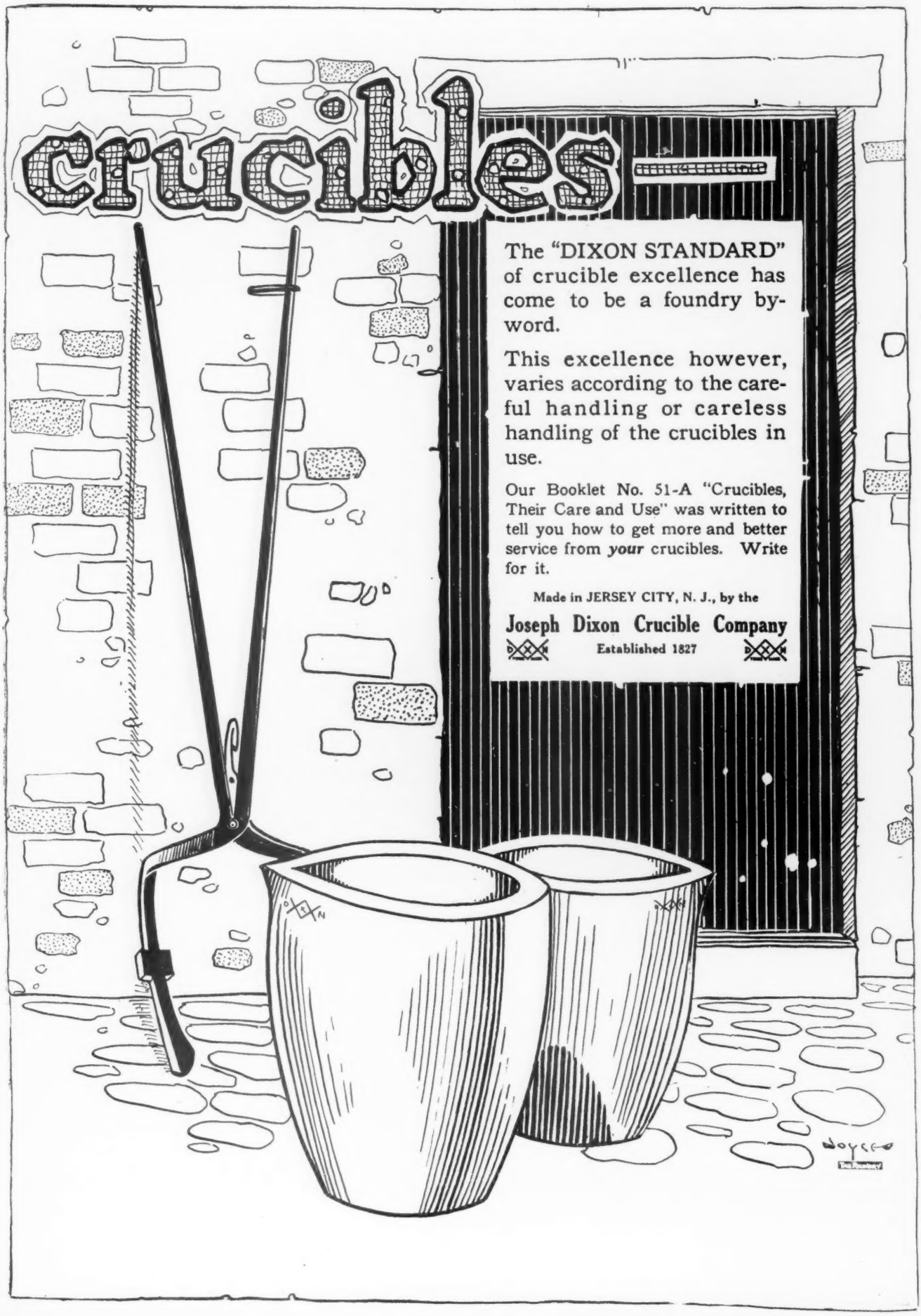
Don't Forget—that Adamant is used for laying up your Blocks or Fire Brick, also gives great satisfaction when used as a protective coating, and it comes packed in special air tight containers already to use—and another thing—if you mix Adamant with some crushed "Fire Brick Bats" you can make your emergency repairs last twice as long, and at very little cost or waste of time.

Anticipating with pleasure your request for a sample

Botfield Specialties Mfg. Co.

776 S. Swanson St.

PHILADELPHIA, PA.


crucibles
The "DIXON STANDARD" of crucible excellence has come to be a foundry by-word.
This excellence however, varies according to the careful handling or careless handling of the crucibles in use.
Our Booklet No. 51-A "Crucibles, Their Care and Use" was written to tell you how to get more and better service from *your* crucibles. Write for it.
Made in JERSEY CITY, N. J., by the
Joseph Dixon Crucible Company
Established 1827

The Fireproof Kid
Wheeler Protected
From Head to Foot

100 PER CENT PROTECTION

Workmen equipped with Wheeler Protective Apparel are 100 per cent protected. This superior line of safety apparel represents body protection equipment developed to its highest point. In design, workmanship and material Wheeler Protective Apparel is unequalled.

For the increased efficiency it gives to your men, for the morale it builds up and for the money you save by using it, equip your men with

PROTECTIVE
WHEELER
APPAREL

THIS TRADEMARK
MEANS SAFETY APPAREL SATISFACTION

Look for the Wheeler trademark when purchasing safety apparel. It is your guarantee of the highest possible quality at the lowest possible price.

Write for illustrated booklet describing the extensive Wheeler Line in detail, which includes Asbestos, Fireproofed Duck and Leather Leggings, Spats, Gloves, Mittens, Helmets, Coats, Pants, Hand Leathers, etc.

WHEELER
Chrome Tan Hand Leather
In Sizes 6 x 8½ and 7 x 9½"

F. H. WHEELER MANUFACTURING CO.
215 West Huron Street - CHICAGO

Bethlehem Mayari Pig Iron

A Nickel-Chromium Alloy Iron for High Grade Castings

Section of Mayari Grinding Plate (Three quarters actual size)

Producers of attrition mill grinding plates who use Mayari Pig Iron in their mixture, as a result obtain a finished product which has unusually good cutting and wearing qualities. Mayari Iron is added in quantities of 30% to 50% to the cupola mixture. Bethlehem Steel Company is ready to assist the Foundry Trade in the application and use of this natural Alloy Iron.

Practical Information in booklet "Mayari Pig Iron."

BETHLEHEM STEEL COMPANY

GENERAL OFFICES, BETHLEHEM, PA.

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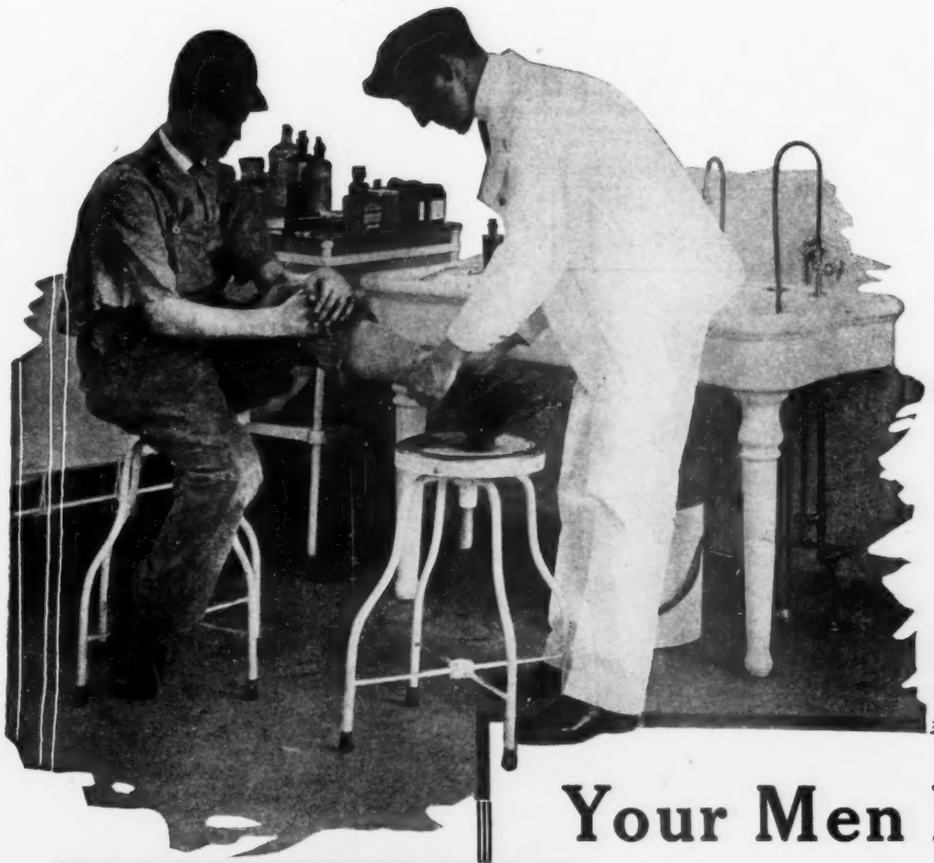
SOLE EXPORTER OF OUR COMMERCIAL STEEL AND IRON PRODUCTS CONSTEEL CONSOLIDATED STEEL CORPORATION 165 BROADWAY, NEW YORK, U.S.A.



QUALITY FIRST SIMPLEX

SAFETY APPAREL

Your Men Need Better Protection

Many times, the loss of a good man from the molding floor could have been prevented by the use of some simple protective device.

Simplex Fire-proofed Molders Leggins and *Spats* are made for just such a purpose.

They form adequate protection against burns from molten metal, are light and comfortable to wear, convenient to put on, and are quickly removed.

The cost is but a very small item—the expense of one preventable accident would equip every molder on the floor with them.

Adopt them today and prevent tomorrow's accident.

The *Simplex Line of Safety Apparel* includes Fire-proofed, water-proofed, and acid-proofed aprons, Pants, Coats, Overalls, etc. Write for our latest price list and illustrated catalog.

Simplex Safety Apparel Co.

1360 N. Wells Street **Chicago, Ill.**

FERRO CARBON TITANIUM F.C.T. Reg. U.S. Pat. Office Trade Mark

MAKING GOOD STEEL BETTER

FERRO CARBON TITANIUM F.C.T. Reg. U.S. Pat. Office Trade Mark

No. 21

Locomotive Main Wheel Center 61" Diameter.

HART-PARR COMPANY

STEEL CASTINGS DIVISION

Charles City, Iowa,

has standardized on Navy B grade steel in their Open Hearth Foundry.

To maintain this high standard constantly they use

FERRO CARBON-TITANIUM

The Titanium Alloy Mfg. Co.

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Own Your Own Truck Filling Station

Buy gasoline and oil in bulk, at quantity prices, and save on the cost of these two big items in trucking operation.

Keep them free from waste, dirt, evaporation and fire in Wayne Storage Tanks.

Get them to every truck in the fleet in the most time, labor and material saving way—with a Wayne Pump installed on your loading platform. Operated by a boy. Speedily and precisely measures and dispenses any quantity at a crank turn. Automatically computes the amounts used and gives you accurate fuel consumption records on each truck.

Wayne Equipment conserves the time of drivers and trucks for trucking. Your trucking efficiency goes up—your trucking costs go down. The investment is small and your savings are large.

Get full facts today. When writing ask for bulletins Nos. 207 F, 65 F and 227 F.

Wayne Oil Tank and Pump Company
747 Canal Street **Fort Wayne, Indiana**

A national organization with sales offices in thirty-four cities. Repair stocks and service at your command.

REG. U.S. Wayne TRADE MARK

OIL STORAGE SYSTEMS

Gasoline and Oil Storage Systems | Heavy Metal Storage Tanks | Oil Filtration Systems | Oil Burning Systems | Furnaces for Metal Melting Forging and Heat Treating

Genuine

MEXICAN PLUMBAGO

unlimited quantities

We can supply Genuine Mexican Plumbago to you in unlimited quantities, for we own and control our own mines in Mexico, and our own mills at Saginaw, Michigan.

U. S. G. Co's Mexican Plumbago is of the strictly highest grade in every respect. It produces clean, smooth castings. It eliminates that rough, scabby condition of your castings which costs so much for cleaning.

It will be your greatest pleasure to tell others about Mexican Plumbago after you have once used it and seen the results.

We make it a business to supply a lead that will meet each and every one of your requirements. Also, our plan of selling ***direct to you*** from our own mines in Mexico, via our own mills in Michigan reduces your plumbago bills to a minimum.

May we ship you a trial order?

The United States Graphite Company

Saginaw, Michigan, U. S. A.

Branch Offices: New York, Chicago, Philadelphia, St. Louis, Pittsburgh, Denver, San Francisco

LARGEST MINERS OF GRAPHITE ON THIS CONTINENT

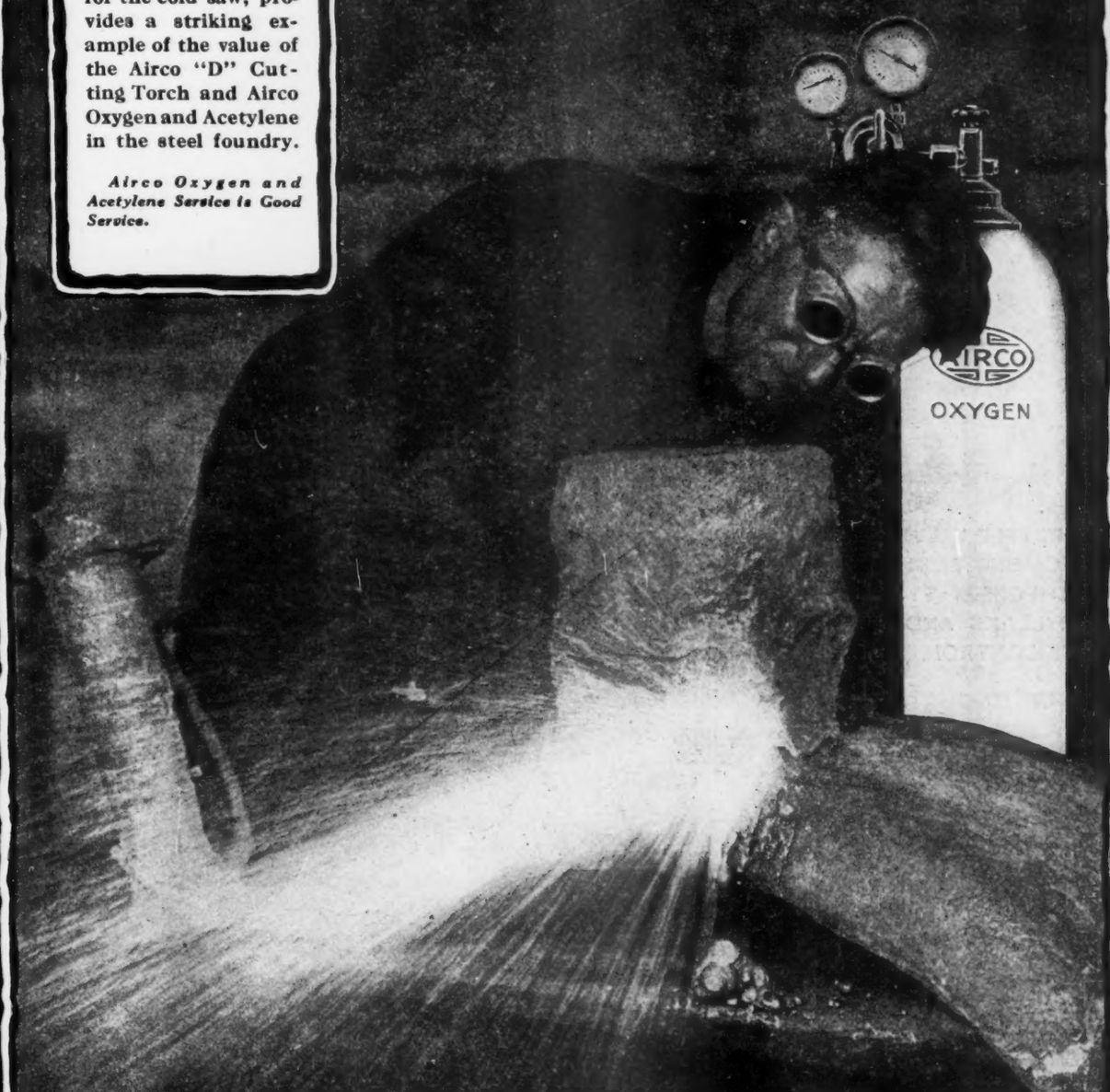
AIRCO

AIRCO OXYGEN
AIRCO ACETYLENE
AIRCO SERVICE

IN REMOVING GATES AND RISERS

from steel castings, a comparison of the time necessary to do the work with an oxy-acetylene torch as against that needed for the cold saw, provides a striking example of the value of the Airco "D" Cutting Torch and Airco Oxygen and Acetylene in the steel foundry.

Airco Oxygen and Acetylene Service is Good Service.



AIRCO PRODUCTS

OXYGEN
ACETYLENE
WELDING AND CUTTING APPARATUS AND SUPPLIES
ACETYLENE GENERATORS
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AIR REDUCTION COMPANY, INC
NEW YORK

AIRCO SERVICE—A DISTRIBUTING STATION NEAR EVERY AIRCO USER

THE REASON WHY

You Should Specify "Little David" Chippers

THE TRIGGER—ONE PIECE FROM SPECIAL SPRING STEEL. HEAT TREATED.

THE HANDLE—A DROP FORGING THAT FITS THE HAND. DOUBLE HEAT TREATED FOR MAXIMUM STRENGTH. SAND BLAST FINISHED TO PROVIDE EXCELLENT GRIP.

THE VALVE—OFFSET FROM THE PISTON BORE; CANNOT BE INJURED BY THE PISTON.

THE THROTTLE VALVE—A COMBINATION PISTON AND POPPET TYPE. NO AIR LEAKS AND SENSITIVE CONTROL.

A SINGLE GROUND JOINT BETWEEN HANDLE AND BARREL. NO THREADED JOINTS TO STRIP OR WORK LOOSE AND LEAK.

HANDLE BOLTS—TWO SPECIAL ALLOY STEEL BOLTS ATTACHING HANDLE TO BARREL.

THE BARREL—A DROP FORGING OF SELECTED STEEL. DOUBLE HEAT TREATED, HARDENED AND GROUND SAND BLAST FINISHED TO PREVENT HAND SLIPPING.

No. 3S Little David Chipper

Catalog 8000 describes Little David Tools

Ingersoll-Rand

General Offices: 11 Broadway, New York

Pneumatically!

PNEUMATIC Rammers readily prove their labor-saving value over slow, laborious hand-tamping.

Thousands of Keller Sand Rammers are speeding up output, producing perfect castings, preventing 10 to 20% metal losses, and revolutionizing molding costs.

Long life and economy of upkeep are insured by complete protection of all working parts against damage from sand. Kellers—powerful, yet easily controlled—stand the "gaff" of hard service and rough usage.

Whether for general foundry work or manufacture of concrete building blocks and kindred products such as sewer covers, chimney caps, sills, curbing, etc., where firm, uniform tamping is essential, there's a Keller Rammer to do the job *better, faster, cheaper with air!*

Bench, floor and suspended types for various classes of work. Ask for bulletin.

Chicago Pneumatic Tool Company

Chicago Pneumatic Building · 6 East 44th Street · New York

*Sales and *Service Branches all over the World*

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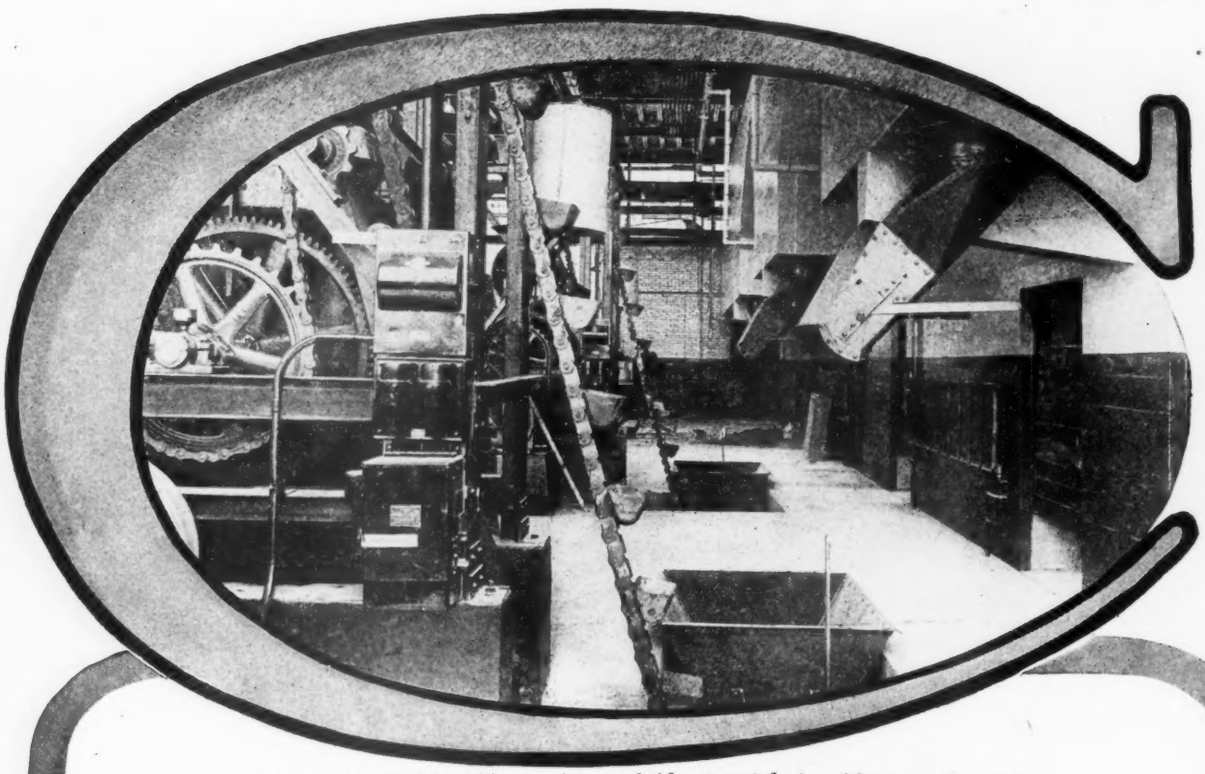
P 92

BOYER PNEUMATIC HAMMERS··LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS··VACUUM PUMPS··PNEUMATIC HOISTS,
GIANT OIL AND GAS ENGINES ROCK DRILLS ·· COAL DRILLS

CHICAGO PNEUMATIC

CHICAGO *Depend upon* **PNEUMATIC** *that Name*



Part of the sand handling equipment laid out and designed by us at the automobile cylinder plant of the Saginaw Products Company, Saginaw, Michigan. Bridge cranes deliver the sand from storage to the hoppers, shown on the right, from which it flows through the processes of mixing to the core room.

Is Your Foundry Making Money?

HOW DO YOU HANDLE

Sand?
Pig Iron?
Coke?
Flasks?
Cores?
Hot Iron?
Castings?
Refuse?

You may not use a hundred tons of core sand a day requiring equipment such as pictured above, but we design material handling equipment for any size job.

Is your foundry making money? Your melting practice may be good, your rigging and equipment in first-class condition, your molding and core room production satisfactory, the percentage of defective work low, and yet you may be losing money, if man power is wasted in handling materials.

Let us tell you how we have solved conveying and handling problems for others. It is more than likely that we can save you money.

FRANK D. CHASE, INC.

ENGINEERS

645 N. MICHIGAN AVE. CHICAGO ILLS.

CAN YOU AFFORD NOT TO DO IT?

Industrial conditions will not be stabilized by a single influence, but through the adoption of a program of constructive betterments by each industrial concern.

What Part Will You Play In This?

Will you find yourself outdistanced by competitors who are organizing for the future?

Will you find yourself without adequate and accurate cost knowledge as your guide in meeting both retrenchment and competition?

Will you find when conditions become normal that you can only secure a proportionate production from your capacity, due to failure to plan and prepare?

Why Not At This Time—

1st—Consider the prospects and demands of the future and prepare to take your place among the leaders?

2nd—Arrange for securing costs which will not only record but control?

3rd—Control production by setting standard hourly productions, and currently and graphically showing actual productions against these standards?

With So Much At Stake—

Even if it does take time and effort;
Even if it does require a reasonable investment;
Even if it does necessitate planning;
Even if it does demand education;

Can You Afford NOT to Do It?

Our service will facilitate the making of your betterment program, and assist in inaugurating the plans decided upon.

Have your Secretary write us now for our Blue Book Series

WE CAN DESCRIBE OUR PLAN BRIEFLY

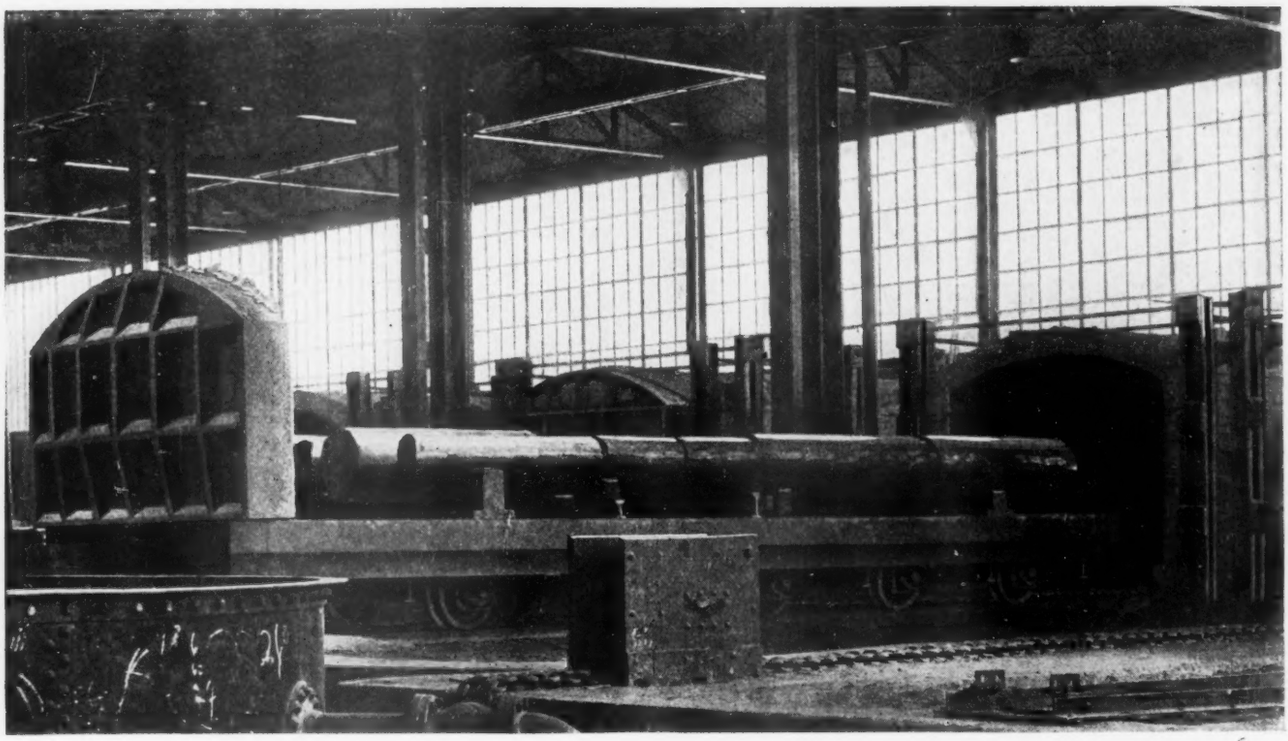
C. E. KNOEPPEL & CO., INC.

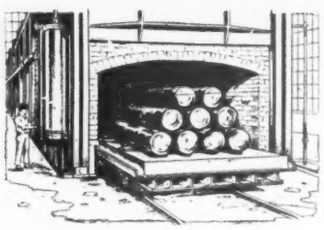
Industrial Engineers

52 Vanderbilt Avenue **New York**

"Knoeppel Organized Service"

EASTON CARS
for every industrial service





ANNEALING FURNACE CARS
to fit any furnace. We build them to practically any length, the largest to date being 40 ft. long and equipped with 7 pairs of wheels.

A NARROW-GAUGE railway system connecting department to department, building to building, laid inside or out. Carrying loads heavy or light, cold or hot. Convenient, smooth-running, ever dependable, a saver of time and man-power—an EASTON.

Easton Cars and industrial railway accessories are available for meeting any haulage requirement, usual or unusual.

Whether it's a single car or a complete equipment—

It's sure to be "right" if it's Easton.

EASTON ENGINEERING SERVICE
is at your disposal, without fee or obligation. Easton Bulletins, too, await your inquiry.

EASTON CARS

EASTON CAR & CONS'T'N CO.

46 Church St., New York — **Works: Easton, Pa.**

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MANHATTAN ABRASIVE WHEELS

Best For Their Work

This is the day of specialization. Industry no longer is satisfied with a fair average of accomplishment. It demands *the best* —from each man, each material, each machine.

It is with this in mind that we have perfected

MANHATTAN
Rubber Bond Abrasive Wheels

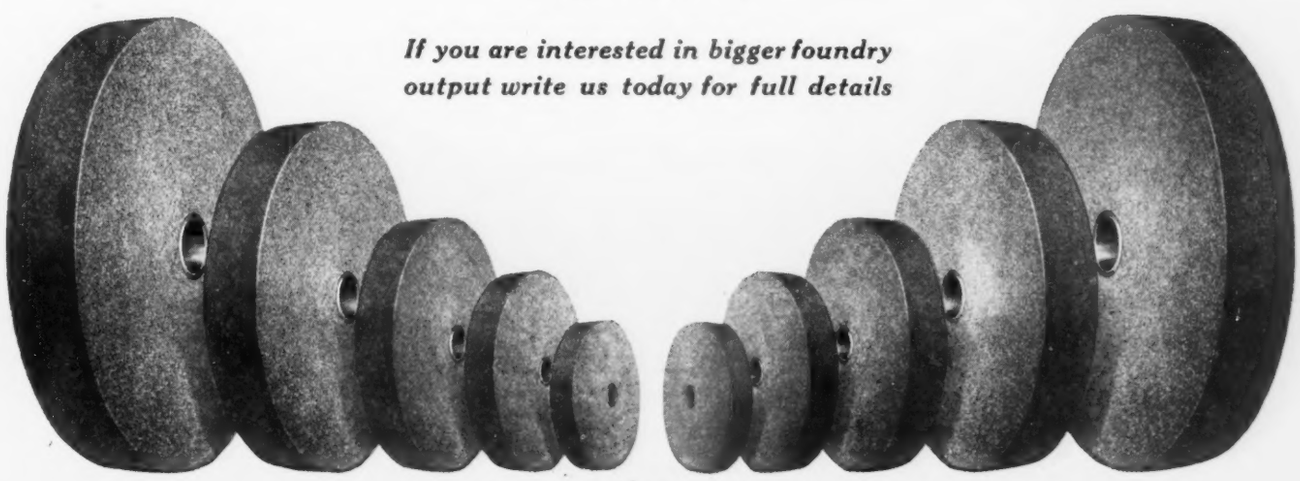
These wheels are made especially for grinding on steel or annealed malleable iron, and in such work they will greatly exceed the results obtainable with ordinary wheels.

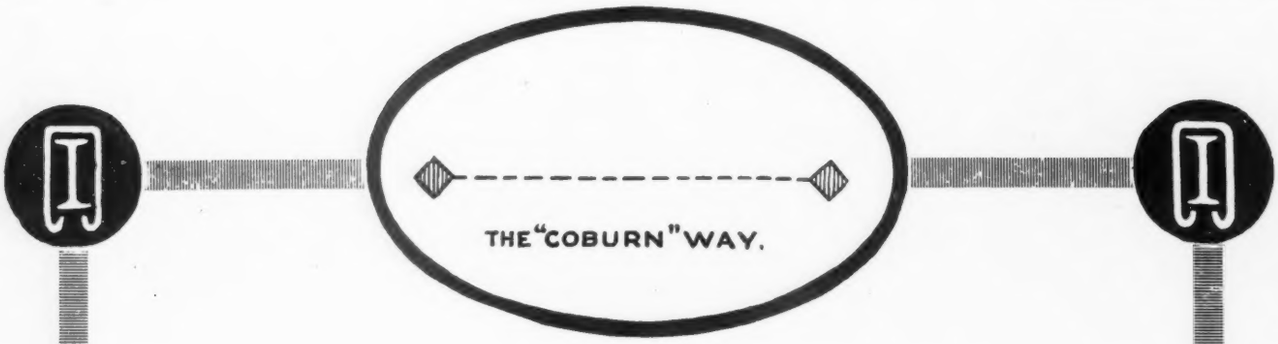
We do not make Manhattan abrasive wheels at present for all phases of grinding,—but on the kinds of work mentioned they are in a class of their own. We are prepared to prove it.

The new Manhattan process of rubber bonding high quality abrasives does away entirely with brittleness and permits of operating safely at the highest speeds.

THE MANHATTAN RUBBER MANUFACTURING COMPANY
PASSAIC, N. J.

If you are interested in bigger foundry output write us today for full details





"A straight line is the shortest distance between two points"

This principle applied to your internal transportation problems will speed up production, save unnecessary delays and increase the amount of floor space available for production. Consider the area of floor space now occupied with surface tracks. The tracks must be kept clear at all times, production is hindered if they are accidentally blocked.

Coburn Overhead Carrying Systems are never blocked. They utilize unused overhead space and release valuable floor space for production. Confusion and disorder are practically eliminated. *Coburn Systems* take the shortest distance between departments and are never obstructed. In many cases where surface tracks cannot be installed you will find *Coburn Systems* are efficiently filling the need.

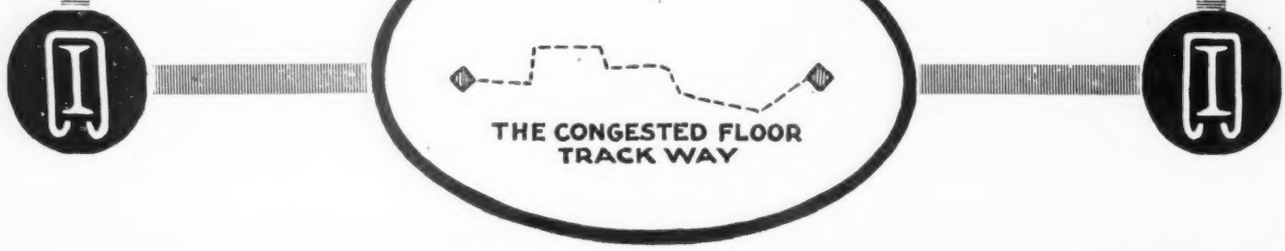
Coburn Systems are used in highly efficient foundries to transport all kinds of materials, hot metal, and castings between departments. They are invaluable for cleaning up floors and removing castings from molds.

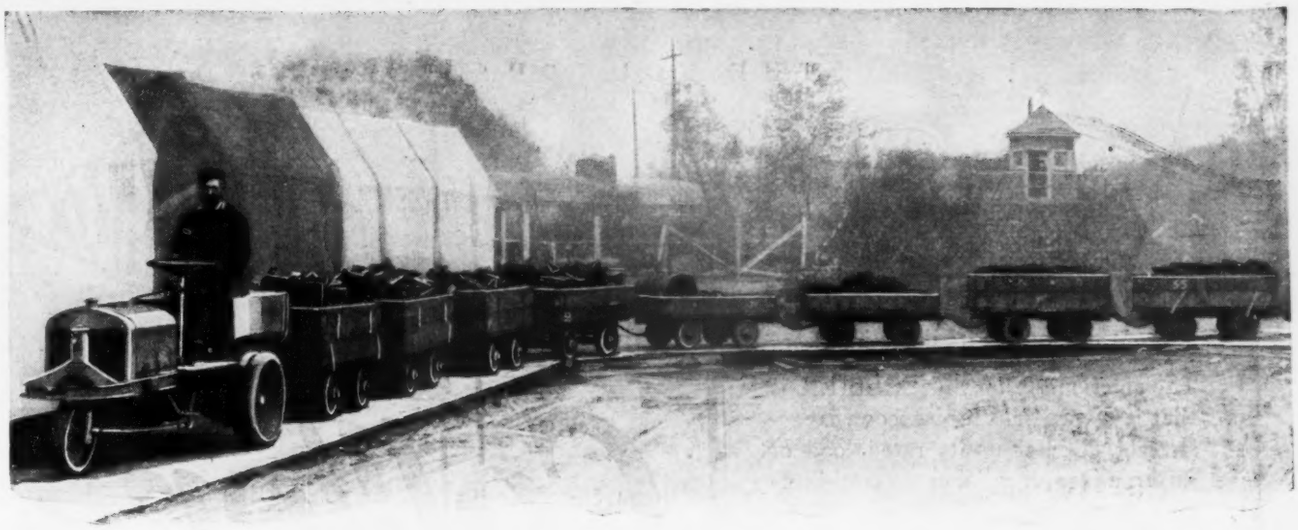
Write for a Coburn Catalog of overhead transportation systems.

COBURN

Trolley Track Mfg. Co.

Holyoke, Mass.





Tructractor Moves Great Quantities of Castings and Raw Materials *QUICKLY*

Gasoline driven, the Clark Tructractor is designed specially to meet haulage needs in foundries. Tows 10 tons or more on trailers. Now used in more than 50 foundries.

Write for Foundry Bulletin showing how the Tructractor fits into your problems.

CLARK TRUCTRACTOR COMPANY

1126 Days Avenue, Buchanan, Michigan

The Tructractor is built locomotive type, Model L, as shown above, for tractor service only, or cargo type, Model M, with several styles of body adapted to foundry use.

CLARK TRUCTRACTOR

The Gasoline Industrial Truck

BLAW-KNOX

The Blaw *Collier* Bucket

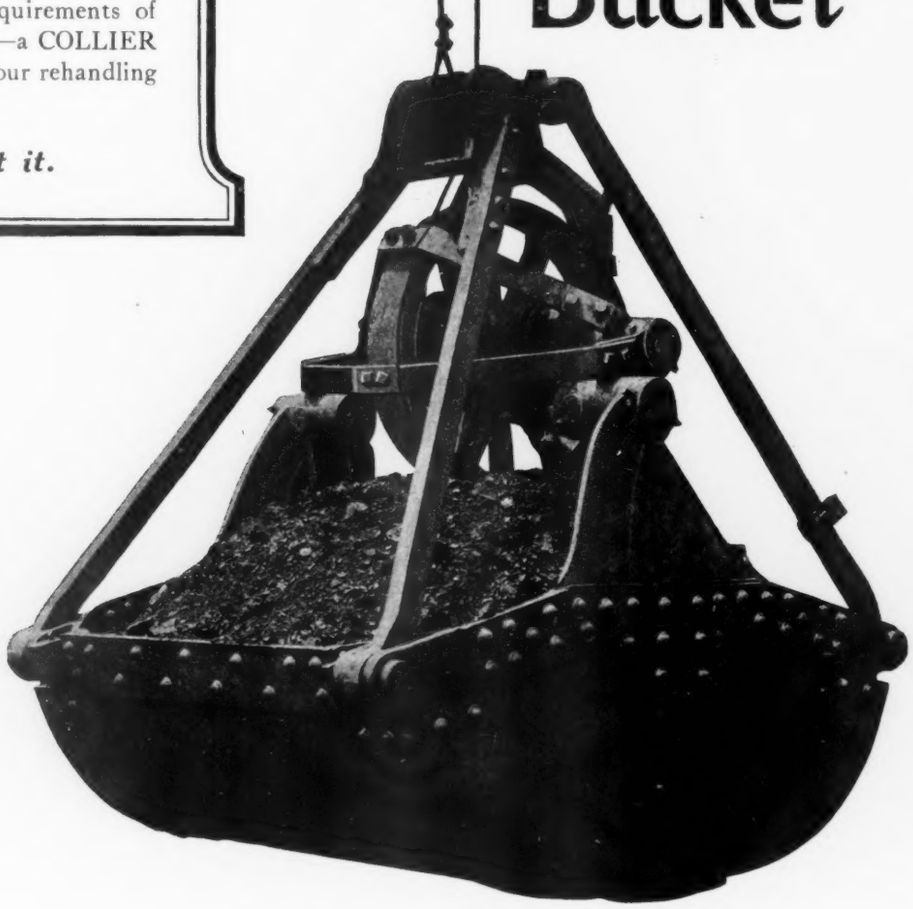
The Blaw Collier is a very light clamshell bucket—intended primarily for the purpose of rehandling coal, coke and anthracite—as its name implies.

The chief merit of the COLLIER is that it is very light for its scoop capacity, yet will pick up its rated load of run of mine, bituminous or semi-bituminous coal, or a heaping load of anthracite in ordinary sized lumps; slack; culm; crushed coal; ashes, etc.

For such services it is ideal.

Embodying all the requirements of strength and durability—a COLLIER installation will solve your rehandling problem.

Ask about it.



Note—These products are built and trade-marked by Blaw-Knox Company: Steel Forms for Concrete Construction—Clamshell Buckets—Fabricated Steel Specialties—Water-Cooled Appliances for High-Temperature Furnaces—Press, Riveted and Welded Plate Work—Standardized Sectional Steel Buildings

BLAW-KNOX COMPANY

PITTSBURGH, PA.
623 Farmers Bank Bldg.

New York - Boston - Chicago
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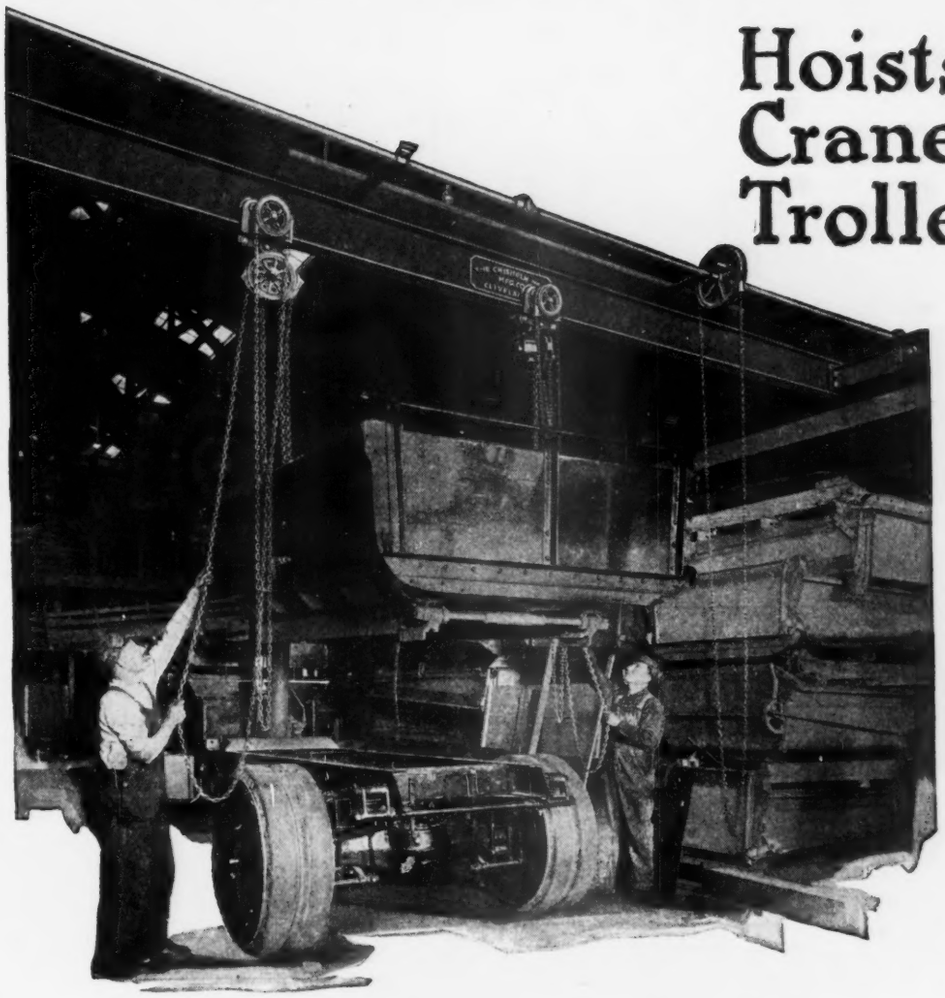
Chisholm-Moore

Hoists Cranes Trolleys



Only Two Men on the Job

CAN you possibly imagine two men handling this heavy unwieldy truck body unaided? Yet it's easy for them with this "C-M" outfit. Give your plant the "once over" and see if you can't make similar savings.

Unless yours is an unusual plant, there are probably places where you could speed up the work or cut the cost with "C-M" appliances. The janitor of an apartment house uses a "Cyclone" Hoist to lift the ash cans out of the basement, while the U. S. Navy uses the same type hoist to feed ammunition to the big guns.

"Cyclone" Hoists from ¼ ton to 40 ton — Cranes, from the simple Jib Crane up to the large traveling Crane-Trolleys, in almost any capacity,— these are all included in the "C-M" line.

The "C-M" Catalog, showing many labor-saving installations, as well as the complete line of "C-M" equipment will be sent on request.

THE CHISHOLM-MOORE MFG. CO., Cleveland, O.

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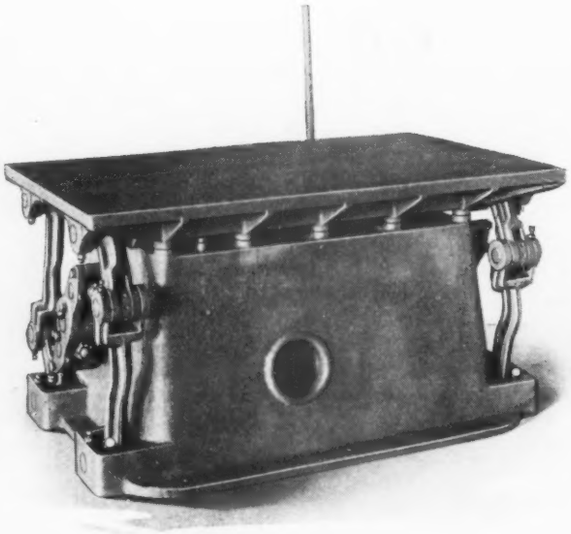
They Operate Electrically



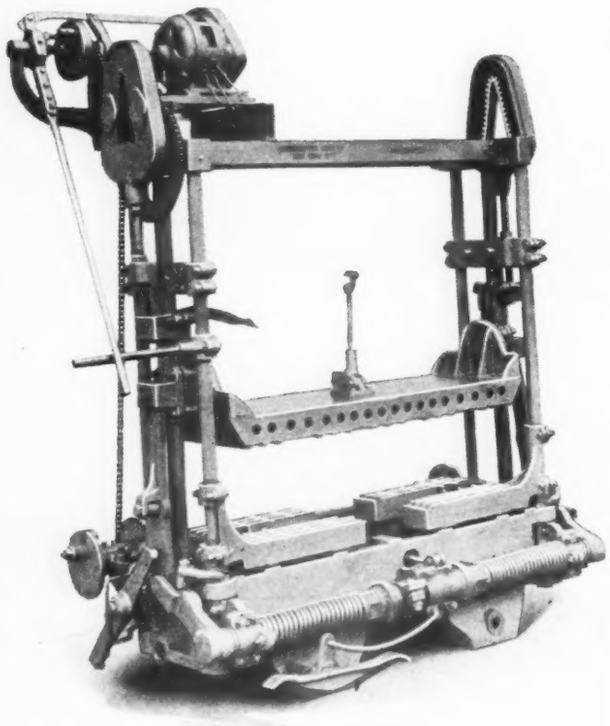
Toggle Lift Jolt Machine *Electric*

A great production booster on heavy work. Valuable also in the cleaning room for removing cores.

Electric power costs much less than compressed air.

This machine gives a solid jolt without rebound. The kind of jolt is of more importance than the frequency. Our toggle operation provides a positive period of rest at each jolt.

Bulletin gives table of sizes and capacities.



Jolt-Rollover-Squeeze-Draw Molding Machine—*Electric*

It makes the complete mold. Molds uniformly perfect. No skill, little effort required.

Handle your production jobs on this machine and reserve your highly paid skilled molders for special hand work.

Bulletin on Electric Molding Machine gives sizes and capacities.

Mounted Patterns outlast unmounted equipment 10 to 1. Make them of American Pattern Compound. Molds like sand. Hardens over night. Saves much skilled labor.

Leaflet on request.

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Western Office & Works: Harvey (Chicago suburb), Ill.
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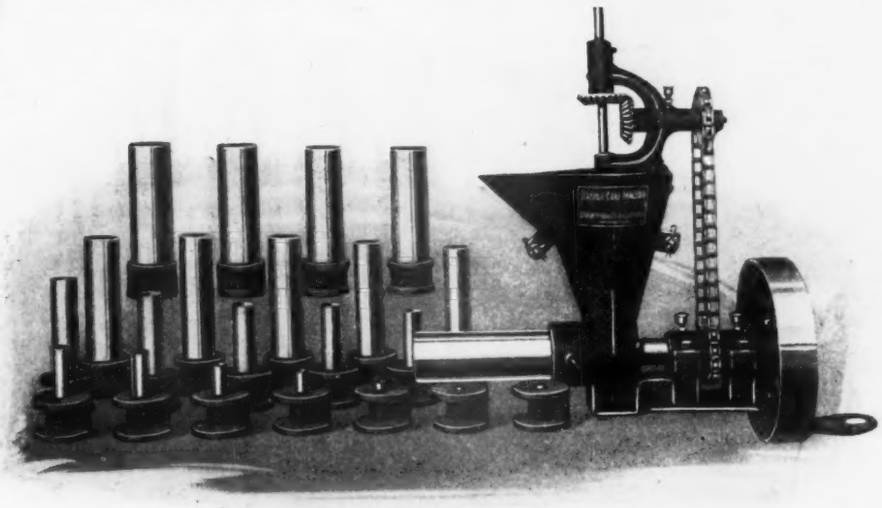
Core Department Too Costly?

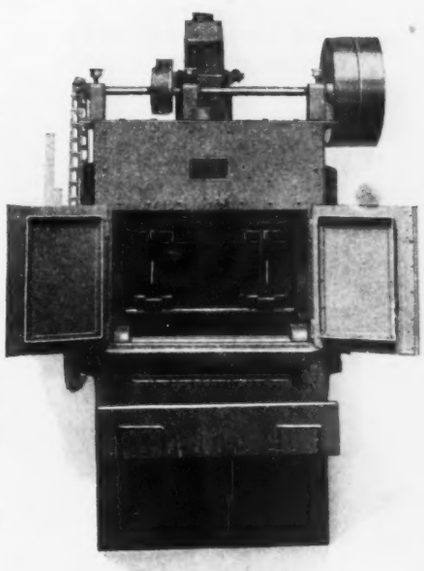


The Hammer Core Machine—4,000 in use

Straight cores—the kind you use most—can be made a mechanical job that any laborer can handle. The Core Machine makes all shapes—round, square, triangular, oval, etc.—in lengths for cutting up as required.

Style A, up to 3-inch diameter; Style B, up to 5-inch diameter;
Style C, up to 7-inch diameter.

"Hammer" is the name, not the method. Ask for catalog.



Sand Blast Barrel No. 1

Gravity Type

The most widely useful sand blast unit made. Ideal for the small run of castings in iron, brass, and bronze.

Complete with automatic sand elevator and screens, dump drawer, water separator, sight sand feed, clutch pulley drive.

Our sand blast catalog shows many types and sizes of dependable equipment.

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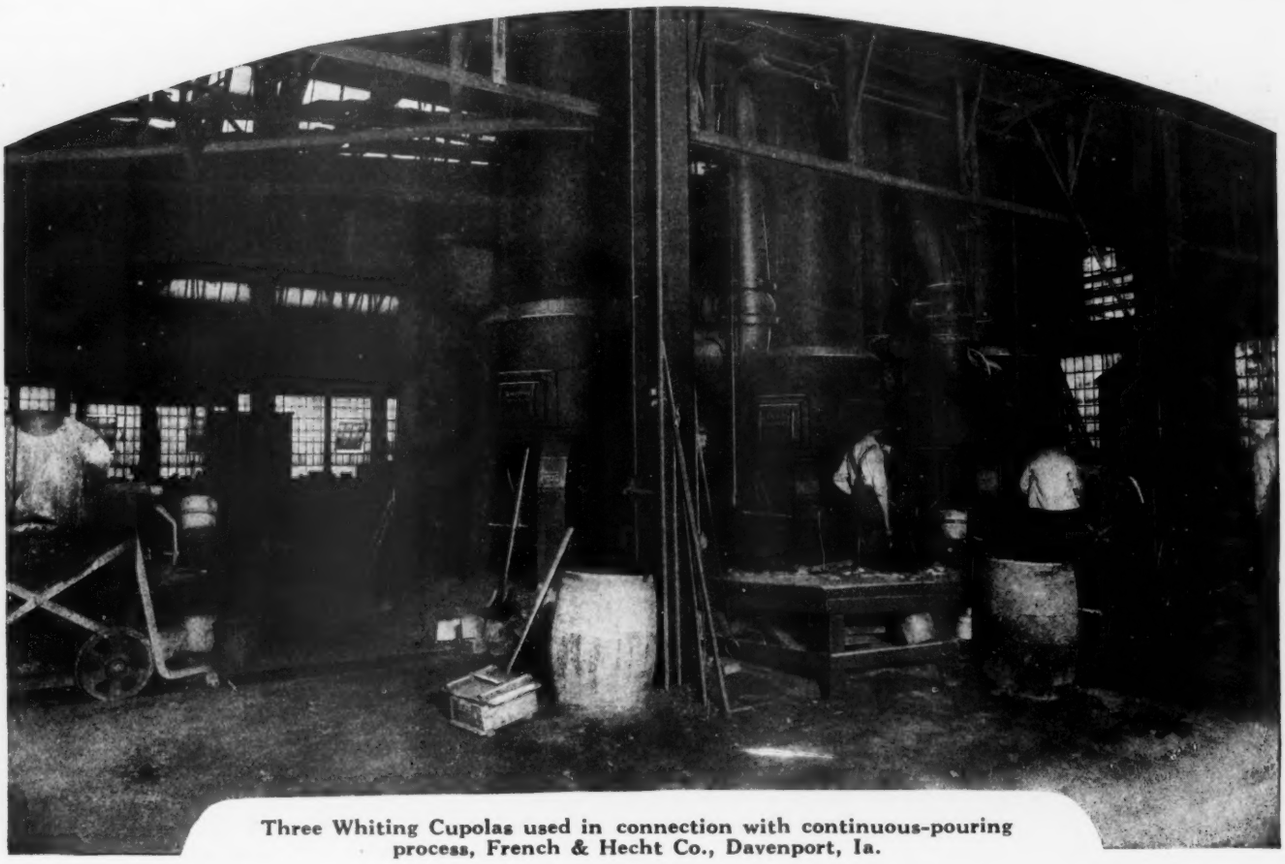

Three Whiting Cupolas used in connection with continuous-pouring process, French & Hecht Co., Davenport, Ia.

We Guarantee Rated Capacity of Hot, Fluid Iron

Read this typical report by our cupola service man:

"They are still operating No. 4 cupola purchased 25 years ago, and getting good results. Mr. W. said they expect to build extension on foundry in a year or two and will want No. 8 cupola, and of course it would be a Whiting, as the present one has been so satisfactory."

If properly operated we guarantee the rated capacity of hot, fluid iron from every Whiting Cupola.

Our service does not stop with shipment; for the benefit of our users we have experienced cupola men make inspection trips from time to time. If a customer is not getting proper results his conditions are analyzed and recommendations made which will overcome the difficulty.

You cannot go wrong in buying a Whiting Cupola. For over 35 years it has been the standard melter for iron foundries, large and small.

Send for catalog and new List of Users.

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He gets also the benefit of our Service Dept. Experienced cranemen make inspection of our installations from time to time to see that cranes are operating properly. In some instances the replacement of a few small parts or the adjustment of others as a result of such inspection has prevented expensive delays.

Our customers are unanimous in their approval of this service. It is a good point to bear in mind when making your next crane purchase.

Send for catalog No. 151.

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Arcade Mfg. Co., Dept. D, Freeport, Ill.
Berkshire Mfg. Co.,
Whitney Power Block, Cleveland, Ohio.
Grimes Molding Machine Co.,
1218 Hastings St., Detroit, Mich.
Kelly, T. P., & Co., Inc.,
355 West 26th St., New York, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland.
Pridmore, Henry E., Inc.,
10th & Rockwell Sts., Chicago, Ill.
Wadsworth Core Mach. & Equip. Co., Akron, O.

CORE OIL
Federal Foundry Supply Co.,
2639 E. 79th St., Cleveland, O.
Holland Core Oil Co.,
4600-08 W. Huron St., Chicago, Ill.
Kellogg, Spencer & Sons, Buffalo, N. Y.
Kelly, T. P., & Co., Inc.
355 West 26th St., New York, N. Y.
McCormick, J. S., Co.,
2428 Railroad St., Pittsburgh, Pa.
Paxson, J. W., Co., Philadelphia, Pa.
Pettinos, Chas., 25 Church St., New York City.
Smith, Werner G., Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Swan & Finch Co., 165 Broadway, New York City
Union Petroleum Co., Philadelphia, Pa.

CORE OVENS
Foundry Equipment Co., The,
1831 Columbus Rd., Cleveland, O.
Holcroft & Co., Book Bldg., Detroit, Mich.
Ohio Body & Blower Co., The, Cleveland, Ohio.
Paxson, J. W., Company,
1021 N. Delaware Ave., Philadelphia
Scully-Jones & Co., Railway Exch. Bldg., Chicago
Ely, W. W., Mfg. Co., 4700 Train Ave., Cleve'd.
Stevens, Frederic B., Detroit, Mich.
Swindell, Wm. & Brothers,
5035 Jenkins Arcade, Pittsburgh, Pa.
Wadsworth Core Mach. & Equip. Co., Akron, O
Whiting Corporation, Harvey, Ill.
Young Brothers Co., Detroit, Mich.

CORE OVEN CAR PULLER
Whiting Corporation, Harvey, Ill.

CORE PLATES (Steel)
Union Metal Mfg. Co., The, Canton, Ohio.
Wadsworth Core Machine & Equipment Co.,
Akron, Ohio.

CORE RACKS
Holcroft & Company, Book Bldg., Detroit, Mich.
Ohio Body & Blower Co., The, Cleveland, Ohio.
Whiting Corporation, Harvey, Ill.

CORE REDUCERS
National Engineering Co., Machinery Hall Bldg., 549 W. Washington St., Chicago, Ill.

CORE RODS
Franklin Core Rod & Gagger Co.,
Buffalo and Third St., Franklin, Pa.

CORE ROOM EQUIPMENT
Wadsworth Core Machine & Equip. Co., Akron, O.

CORE SAND MIXERS
American Foundry Equipment Co.,
366 Madison Ave., New York City.
National Engineering Co., Machinery Hall Bldg., 549 W. Washington St., Chicago, Ill.
Wadsworth Core Machine & Equip. Co., Akron, O.

CORE TAPERING AND CUTTING OFF MACHINES
Wadsworth Core Machine & Equip. Co., Akron, O.

CORE TESTING MACHINES
Wadsworth Core Machine & Equip. Co., Akron, O.

CORE WASH
Columbian Facing Mills, Inc.,
93 Stone St., Buffalo, N. Y.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Federal Foundry Supply Co.,
2639 E. 79th St., Cleveland, O.
Kelly, T. P., & Co., Inc.,
355 West 26th St., New York, N. Y.
Obermayer, S., Co., 2563 W. 18th St., Chicago.
Paxson, J. W., Company,
1021 N. Delaware Ave., Philadelphia.
Pettinos, Chas., 25 Church St., New York City.
Pettinos, George F., Real Estate Bldg., Phila.
Stevens, Frederic B., Detroit, Mich.
United Compound Co., 228 Elk St., Buffalo, N. Y.
United States Graphite Co., Saginaw, Mich.

CORE WAX
United Compound Co., 228 Elk St., Buffalo, N. Y.

CORRESPONDENCE SCHOOLS
McLain's System, Inc.
803 Goldsmith Bldg., Milwaukee, Wis.

COUPLINGS (Flexible)
Roots, P. H. & F. M., Co., Connersville, Ind.

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Toledo, O.
Armington Engineering Co., The, Euclid, Ohio.
Chesapeake Iron Works, Baltimore, Md.
Link-Belt Company, Chicago, Ill.
McCormick, J. S., Co.,
2428 Railroad St., Pittsburgh, Pa.
New Jersey Foundry & Machine Co.,
90 West St., New York.
Niles-Bement-Pond Co., 111 Broadway, N. Y. C.
Northern Engineering Works, 4 Chene St., Detroit
Sellers, Wm., & Co., Inc., Philadelphia, Pa.
Shepard Electric Crane & Hoist Co.,
Montour Falls, N. Y
Whiting Corporation, Harvey, Ill.

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Whiting Corporation, Harvey, Ill.

CRANES (Electric Traveling)
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Link-Belt Company, Chicago, Ill.
Manning, Maxwell & Moore, Inc.,
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Milwaukee Electric Crane & Mfg. Co., Milwaukee.
New Jersey Foundry & Machine Co.,
90 West St., New York.
Niles-Bement-Pond Co., 111 Broadway, N. Y. C.
Northern Engineering Works, 4 Chene St., Detroit.
Scully-Jones & Co., Railway Exch. Bldg., Chicago.
Whiting Corporation, Harvey, Ill.

CRANES (Hand Traveling)
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Coburn Trolley Track Mfg. Co., The,
Holyoke, Mass.
Chisholm-Moore Mfg. Co., Cleveland, O.
Manning, Maxwell & Moore, Inc.,
119 W. 40th St., New York.
Milwaukee Electric Crane & Mfg. Co., Milwaukee.
New Jersey Foundry & Machine Co.,
90 West St., New York.
Niles-Bement-Pond Co., 111 Broadway, N. Y. C.
Northern Engineering Works, 4 Chene St., Detroit.
Whiting Corporation, Harvey, Ill.

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Armington Engineering Co., The, Euclid, Ohio.
Manning, Maxwell & Moore, Inc.,
119 W. 40th St., New York.
New Jersey Foundry & Machine Co.,
90 West St., New York.
Northern Engineering Works, 4 Chene St., Detroit.
Whiting Corporation, Harvey, Ill.

CRANES (Locomotive)
Link Belt Co., Chicago, Ill.

CRANES (Monorail)
Northern Engineering Works,
4 Chene St., Detroit, Mich.

CRANES (Wall)
Niles-Bement-Pond Co., 111 Broadway, N. Y. C.
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Lava Crucible Co. of Pittsburgh,
1603 First Nat'l Bank Bldg., Pittsburgh, Pa.
McCormick, J. S., Co.,
2428 Railroad St., Pittsburgh, Pa.
Ross-Tacony Crucible Co.
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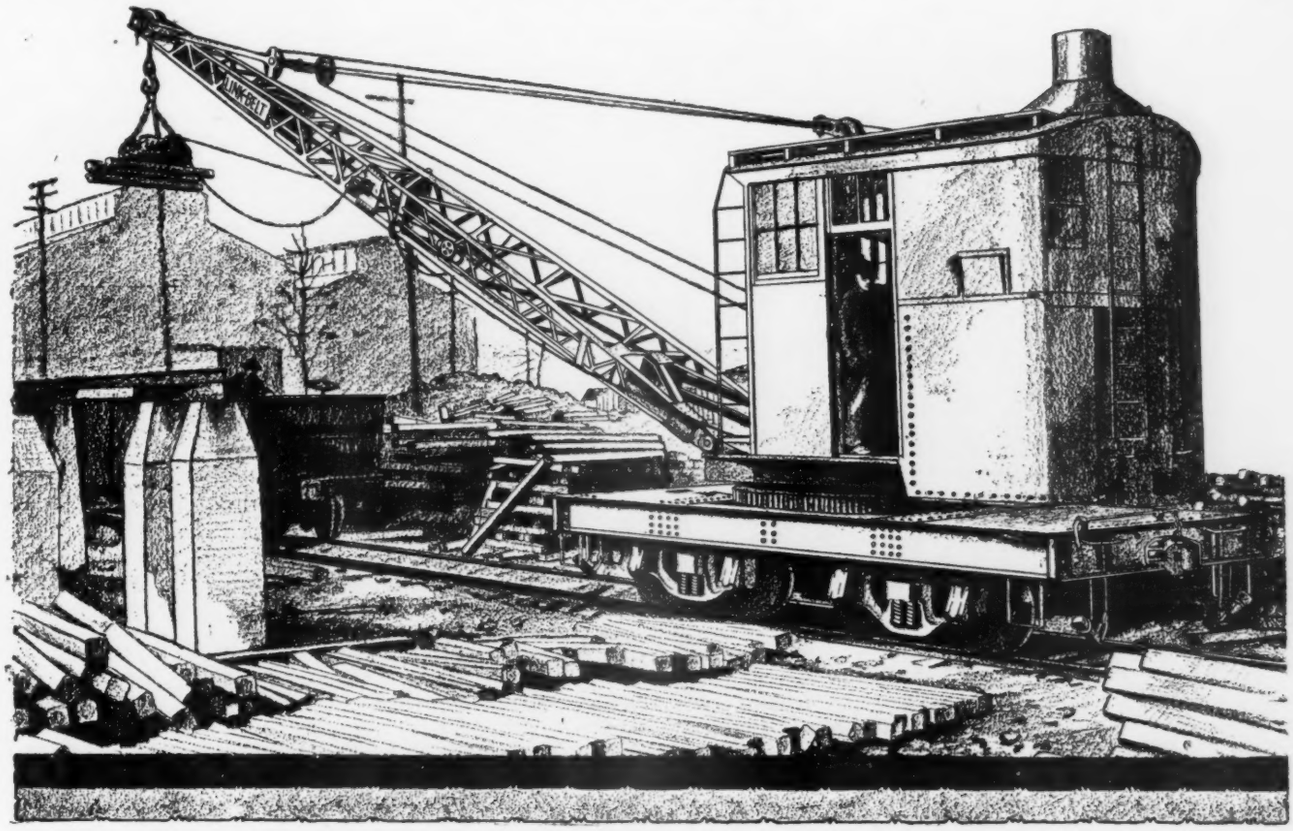

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Whiting Corporation, Harvey, Ill.

CUPOLA CHARGING MACHINE
Whiting Corporation, Harvey, Ill.

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Stevens, Frederic B., Larned & Third Sts., Detroit.

CUPOLA LIGHTERS
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Botfield Specialties Mfg. Co.,
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Paxson, J. W., Co., Philadelphia, Pa.
Scully-Jones & Co., Railway Exch. Bldg., Chicago.
Tropenas Co., 2243 Nostrand, Brooklyn.
Whiting Corporation, Harvey, Ill.

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CUTTING AND WELDING (Oxy-Acetylene)—See WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene Process)

CYLINDERS (Acetylene)—See ACETYLENE IN CYLINDERS

CYLINDERS (Oxygen)—See OXYGEN IN CYLINDERS

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Independent Pneumatic Tool Co.,
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Milwaukee Electric Crane & Mfg. Co., Milwaukee.

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Cleveland Pneumatic Tool Co., Cleveland, Ohio.
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Pangborn Corporation,
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Knickerbocker Co., 516 Liberty St., Jackson, Mich.
Macleod Co., Bogen St., Cincinnati, O.
Mott Sand-Blast Mfg. Co., Inc., New York.
Pangborn Corporation, P. O. Box 851,
Hagerstown, Md.
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ELEVATORS (Bucket)
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Bennett, W. C., 189 W. Madison St., Chicago, Ill.
Chase, Frank D.,
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Hardy, The Clement A., Company,
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Grimes Molding Machine Co.,
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Kawin, Charles C., Co.,
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Knoeppel, C. E. & Co., Inc.,
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National Engineering Co., Machinery Hall Bldg.,
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ENGINEERS AND CONTRACTORS
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Holcroft & Company, Book Bldg., Detroit, Mich.
Swindell, Wm. & Brothers,
5035 Jenkins Arcade, Pittsburgh, Pa.
Wickland, A. A. and Associates,
105 W. Monroe St., Chicago, Ill.

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Easton Car & Construction Co., Easton, Pa.
Ingersoll-Rand Co., 11 Broadway, N. Y. C.

ENGINES (Steam)
Easton Car & Construction Co., Easton, Pa.

EXHAUSTERS (Gas)
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Hoevel Mfg. Corp.,
154 Ogden Ave., Jersey City, N. J.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Sly, W. W., Mfg. Co., 4700 Train Ave., Cleve'd.
Standard Equipment Co., The,
Chamber of Commerce Bldg., New Haven, Conn.

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Blue Ridge Talc Co., Inc., Henry, Va.
Columbian Facing Mills, Inc.,
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Dixon, Jos., Crucible Co., Jersey City, N. J.
Federal Foundry Supply Co.,
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Holland Core Oil Co.,
4600-08 Huron St., Chicago, Ill.
Kelly, T. P., & Co., Inc.,
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McCormick, J. S., Co.,
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Obermayer, S., Co., 2563 W. 18th St., Chicago.
Paxson, J. W., Company,
1021 N. Delaware Ave., Philadelphia, Pa.
Pettinos, Chas., 25 Church St., New York City.
Pettinos, George E., Real Estate Bldg., Phila.
Springfield Facing Co.,
317 Main St., Springfield, Mass.
Stevens, Frederic B., Detroit, Mich.
U. S. Graphite Co., Saginaw, Mich.

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366 Madison Ave., New York.
National Engineering Co., Machinery Hall Bldg.,
549 W. Washington St., Chicago, Ill.
Wadsworth Core Machine & Equip. Co., Akron, O.

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Pangborn Corp., P. O. Box 851, Hagerstown, Md.

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Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

FERRO MANGANESE
Bethlehem Steel Co., Bethlehem, Pa.

FERRO-SILICON
Keokuk Electro-Metals Co.,
1518 Corn Exchange Bk. Bldg., Chicago, Ill.

FERRO-TITANIUM
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

FILLET (Leather, Wood, Paper)
Combined Supply & Equipment Co.,
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Kindt-Collins Co.,
1030 St. Clair Ave., Cleveland, Ohio.

FIRE BRICK AND CLAY
Stevens, Frederic B., Detroit, Mich.

FIREPROOF CLOTHING
Wheeler, F. H., Mfg. Co.,
215 W. Huron St., Chicago, Ill.

FIRE SAND
Pettinos, Chas., 25 Church St., New York City.
Pettinos, George F., Real Estate Bldg., Phila.

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American Foundry Equipment Co.,
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Arcade Mfg. Co., Dept. D, Freeport, Ill.
Berkshire Mfg. Co.,
Whitney Power Block, Cleveland, Ohio.
Bryan Pattern & Machine Co., Bryan, Ohio.
Diamond Clamp & Flask Co.,
38-40 N. 14th St., Richmond, Ind.
Madison Pattern & Flask Works, The,
10108 Detroit Ave., Cleveland, Ohio.
Obermayer, S., Co., 2563 W. 18th St., Chicago.
Sterling Wheelbarrow Co., 64th Ave., Milwaukee.
Truscon Steel Co., Detroit, Mich.
Union Metal Mfg. Co., The, Canton, Ohio.

FLOUR
Holland Core Oil Co.,
4600-08 Huron St., Chicago, Ill.

FLOUR (Foundry)
Paxson, J. W., Co., Philadelphia, Pa.
Holland Core Oil Co.,
4600-08 Huron St., Chicago, Ill.

FLUOR SPAR
Paxson, J. W., Co., Philadelphia, Pa.

FLOUR (Tripoli)
American Tripoli Co., Seneca, Mo.

FLUX (Iron, Brass, Steel or Aluminum)
Paxson, J. W., Co., Philadelphia, Pa.

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215 W. Huron St., Chicago, Ill.

FORGES (Oil)
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431 South Dearborn St., Chicago, Ill.

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American Foundry Equipment Co.,
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Arcade Mfg. Co., Dept. D, Freeport, Ill.
Chesapeake Iron Works, Baltimore, Md.
Combined Supply & Equipment Co.,
766-772 Grant St., Buffalo, N. Y.
Electric Furnace Co., The, Alliance, O.
Foundry Equipment Co., The,
1831 Columbus Rd., Cleveland, O.
Henderson Brothers Co.,
133 So. Leonard, Waterbury, Conn.
Hoevel Mfg. Corp.,
154 Ogden Ave., Jersey City, N. J.
Holcroft & Co., Book Bldg., Detroit, Mich.
Industrial Air Eng. Co.,
311 Perry Payne Bldg., Cleveland, O.
Mott Sand Blast Mfg. Co., Inc.,
8 Frost St., Brooklyn, N. Y.
National Engineering Co., Machinery Hall Bldg.,
549 W. Washington St., Chicago, Ill.
Obermayer, S., Co., 2563 W. 18th St., Chicago.
Ohio Body & Blower Co., The, Cleveland, Ohio.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Peck Iron & Steel Works, Vicksburg, Mich.
Penn Foundry & Mfg. Co., Reading, Pa.
Pridmore, Henry E., Inc.,
19th & Rockwell Sts., Chicago, Ill.
Sly, W. W., Mfg. Co., 4700 Train Ave., Cleve'd.
Standard Equipment Co., The,
Chamber of Commerce Bldg., New Haven, Conn.
Standard Sand & Machine Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Whiting Corporation, Harvey, Ill.

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Clifton-Pratt Co., The, Cincinnati, O.
Crawford, F. H., 305 Broadway, New York City.
Federal Fdry. Supply Co., The, Cleveland, O.
McCormick, J. S., Co., Pittsburgh, Pa.
Scully-Jones & Co., Chicago, Ill.

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FOUNDRY SPECIALISTS
Booth Electric Furnace Co.,
330 W. Madison Ave., Chicago, Ill.
Holcroft & Company, Book Bldg., Detroit, Mich.
Kawin, Charles C., Co.,
431 South Dearborn St., Chicago, Ill.
McLain's System, Inc.,
803 Goldsmith Bldg., Milwaukee, Wis.
Pangborn Corporation,
P. O. Box 851, Hagerstown, Md.
Whiting Corporation, Harvey, Ill.

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Bloomsbury Graphite Co., Bloomsbury, N. J.
Columbian Facing Mills, Inc.,
93 Stone St., Buffalo, N. Y.
Electric Furnace Co., The, Alliance, O.
Federal Foundry Supply Co.,
2639 E. 79th St., Cleveland, O.
Holland Core Oil Co.,
4600-08 Huron St., Chicago, Ill.
Kelly, T. P., & Co., Inc.,
355 West 26th St., New York City.
Mott Sand Blast Mfg. Co., Inc.,
8 Frost St., Brooklyn, N. Y.
National Engineering Co., Machinery Hall Bldg.,
549 W. Washington St., Chicago, Ill.
Obermayer, S., Co., 2563 W. 18th St., Chicago.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Pettinos, Chas., 25 Church St., New York City.
Pettinos, George F., Real Estate Bldg., Phila.
Sly, W. W., Mfg. Co., 4700 Train Ave., Cleve'd.
Stevens, Frederic B., Detroit, Mich.

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Maxon Furnace & Engineering Co., Muncie, Ind.

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Botfield Specialties Mfg. Co.,
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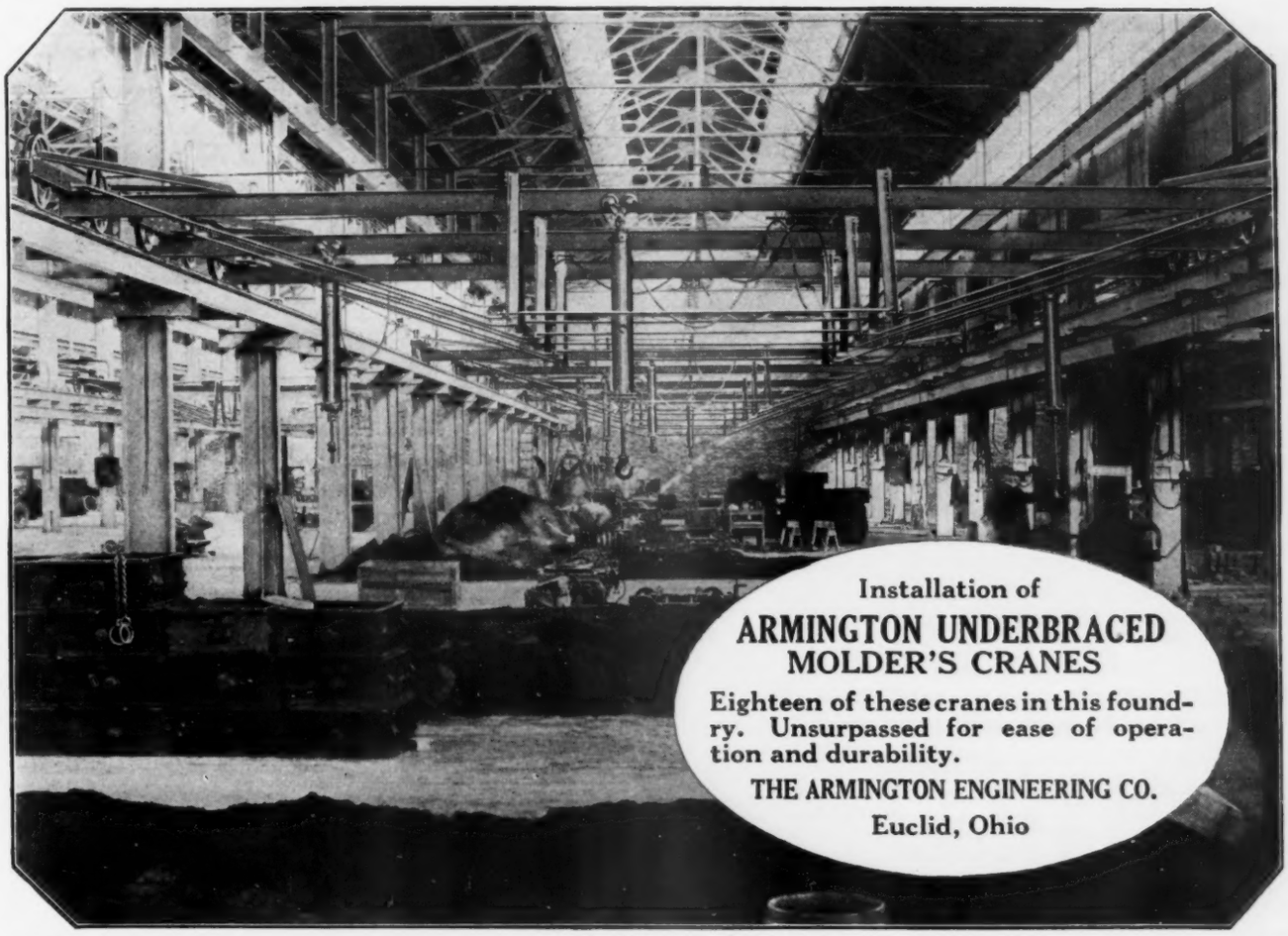
McPhee Cement Co., Inc., Scranton, Pa.

FURNACE LININGS (Graphite)
Dixon, Joseph, Crucible Co., Jersey City, N. J.

FURNACES
Electric Furnace Co., The, Alliance, O.
Foundry Equipment Co., The,
1831 Columbus Rd., Cleveland, O.
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.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Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
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Stevens, Frederic B., Detroit, Mich.
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Whiting Corporation, Harvey, Ill.

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Electric Furnace Co., The, Alliance, O.

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Hoskins Mfg. Co., 453-71 Lawton Ave., Detroit.
Industrial Electric Furnace Co., Chicago.
Pittsburgh Electric Furnace Corp., Union Bank Bldg., Pittsburgh, Pa.

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Holcroft & Company, Book Bldg., Detroit, Mich.

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Swindell, Wm., & Brothers, 5035 Jenkins Arcade, Pittsburgh, Pa.

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Swindell, Wm., & Brothers, 5035 Jenkins Arcade, Pittsburgh, Pa.
Whiting Corporation, Harvey, Ill.

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Electric Furnaces Construction Co., 908 Chestnut St., Philadelphia, Pa.
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Holcroft & Co., Book Bldg., Detroit, Mich.
Industrial Electric Furnace Co., Chicago, Ill.
McLain's System, Inc., 803 Goldsmith Bldg., Milwaukee, Wis.
Pittsburgh Electric Furnace Corp., Pittsburgh, Pa.
Wayne Oil Tank & Pump Co., 747 Canal St., Fort Wayne, Ind.

FURNACES (Oil)
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Wayne Oil Tank & Pump Co., 747 Canal St., Ft. Wayne, Ind.

FURNACES (Open Hearth)
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McLain's System, Inc., 803 Goldsmith Bldg., Milwaukee, Wis.
Swindell, Wm., & Brothers, 5035 Jenkins Arcade, Pittsburgh, Pa.

FURNACES (Tilting, Crucible and Non-Crucible Oil Burning)
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FURNITURE
Chicago Safe & Merchandise Co., 75 W. Lake St., Chicago, Ill.

CAGES
Wayne Oil Tank & Pump Co., 747 Canal St., Ft. Wayne, Ind.

GAGGERS
Franklin Core Rod & Gagger Co., Buffalo and Third Sts., Franklin, Pa.

GAGGER MOLDS (Air Cooled)
Wadsworth Core Mch. & Equipment Co., Akron, O.

GALVANIZED FLUX
United American Metals Corp., Syracuse Smelting Works, Subsidiary, Diamond St., Brooklyn, N. Y.

GAS BOOSTERS (Rotary)
P. H. & F. M. Roots Co., Connersville, Ind.

GASES (Electrolytic)
Gas Products Association, 801 Marquette Bldg., Chicago, Ill.

GAS EXHAUSTERS (Rotary Positive Pressure)
Roots, P. H. & F. M., Co., Connersville, Ind.

GAS PRODUCERS
Holcroft & Company, Book Bldg., Detroit, Mich.

GEAR HOBBERS
Adams Co., The, 106 Iron St., Dubuque, Iowa.

GEAR TESTERS
Adams Co., The, 106 Iron St., Dubuque, Iowa.

GENERATORS (Oxy-Acetylene, Oxygen, Hydrogen)
Air Reduction Co., 120 Broadway, N. Y.

GIRDERS (Steel)
Peck Iron & Steel Works, Vicksburg, Mich.

GLOVES AND MITTENS (Asbestos and Leather)
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Safety Equipment Service Co., The, E. 11th St. and Hamilton Ave., Cleveland, O.
Wheeler, F. H., Mfg. Co., 215 W. Huron St., Chicago, Ill.

GLOVES (Foundry)
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.
Wheeler, F. H., Mfg. Co., 215 W. Huron St., Chicago, Ill.

GLOVES (Sand Blast)
Pangborn Corp., P. O. Box 851, Hagerstown, Md.

GLOVES (Steel Grip)
Industrial Glove Corp., 2535 W. Schubert Ave., Chicago, Ill.
Pangborn Corporation, P. O. Box 851, Hagerstown, Md.

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Safety Equipment Service Co., The, E. 11th St. and Hamilton Ave., Cleveland, O.

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Gardner Governor Co., The, Quincy, Ill.

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Obermayer, S., Co., 2563 W. 18th St., Chicago.
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United States Graphite Co., Saginaw, Mich.

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Swan & Finch Co., 165 Broadway, New York City.
United States Graphite Co., Saginaw, Mich.

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GRINDERS (Disc)
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Chicago Pneumatic Tool Co., 6 East 44th St., New York.

GRINDERS (Pneumatic Portable)
Chicago Pneumatic Tool Co., 6 E. 44th St., New York.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, N. Y. C.

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National Engineering Co., Machinery Hall Bldg., 549 W. Washington St., Chicago, Ill.
Phillips & McLaren Co., 24th and Smallman Sts., Pittsburgh, Pa.

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Dayton Grinding Wheel Co., Dayton, O.

GRINDING WHEEL PLATES (Steel)
Moltrup Steel Products Co., Beaver Falls, Pa.

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Mott Sand-Blast Mfg. Co., Inc., New York.
New Haven Sand Blast Co., 144 Water St., New Haven, Conn.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Standard Equipment Co., The, Chamber of Commerce Bldg., New Haven, Conn.

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Harrison Supply Co., 5 and 7 Dorchester Ave. Extension, Boston Mass.
Pangborn Corp., P. O. Box 851, Hagerstown, Md.

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Wheeler, F. H., Mfg. Co., 215 W. Huron St., Chicago, Ill.

GUNS (Spray)—See SPRAY GUNS

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York.
Cleveland Pneumatic Tool Co., Cleveland, Ohio.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.
Ingersoll-Rand Co., 11 Broadway, New York City.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Oldham, Geo., & Son Co., Scott and McHenry Sts., Philadelphia, Pa.

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HANGERS (Shaft)
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Skinner Brothers Mfg. Co., St. Louis, Mo.

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HELMETS (Sandblast)
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Pulmosan Safety Equipment Co., 45 Willoughby St., Brooklyn, N. Y.
Safety Equipment Service Co., The, E. 11th St. and Hamilton Ave., Cleveland, O.

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Sellers, Wm., & Co., Inc., Philadelphia, Pa.

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Northern Engineering Works, 4 Chene St., Detroit.

HOISTS (Electric)
Box, Alfred & Co., Inc., Philadelphia, Pa.
Link Belt Co., Chicago, Ill.
Manning, Maxwell & Moore, Inc., 119 W. 40th St., New York.
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HOISTS (Hand)
Armington Engineering Co., The, Euclid, Ohio.
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Whiting Corporation, Harvey, Ill.

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Ingersoll-Rand Co., 11 Broadway, New York City.
Whiting Corporation, Harvey, Ill.

HOISTS (Skip)
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HOSE COUPLINGS (Pneumatic)
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Pangborn Corp., P. O. Box 851, Hagerstown, Md.
Standard Equipment Co., The, Chamber of Commerce Bldg., New Haven, Conn.

HYDROGEN
Gas Products Association, 801 Marquette Bldg., Chicago, Ill.

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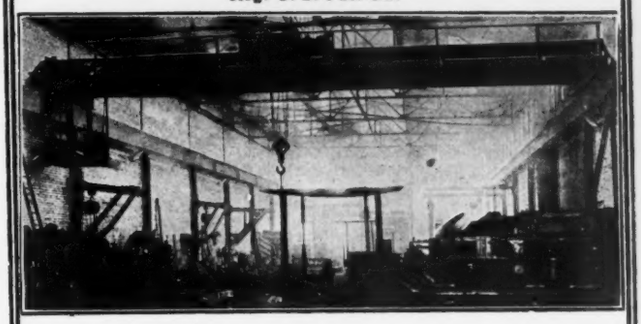

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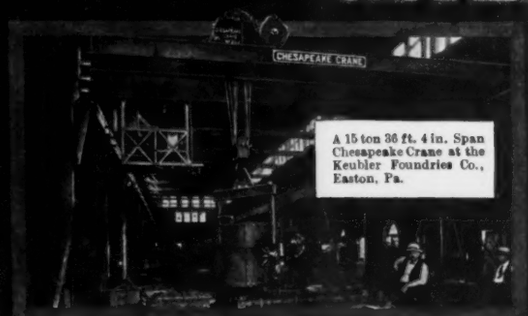

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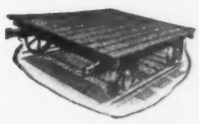

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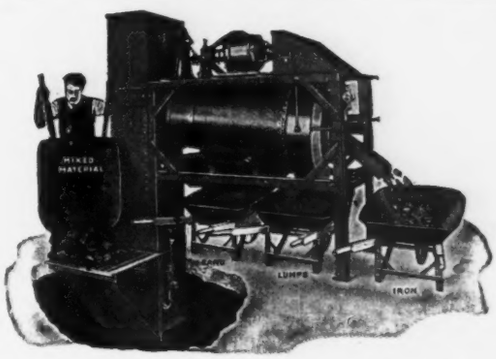

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Whiting Corporation, Harvey, Ill.

TURBO BLOWERS—See BLOWERS

TURNTABLES
Chase Foundry & Mfg. Co., The, Columbus, O.
Easton Car & Construction Co., Easton, Pa.
Scully-Jones & Co., Railway Exch. Bldg., Chicago.
Sellers, Wm., & Co., Inc., Philadelphia, Pa.
Whiting Corporation, Harvey, Ill.

VALVES
Westinghouse Traction Brake Co., Wilmerding, Pa.

VALVES (Blow Off and Cut Off)
Beryk Co., 1265 West 2nd St., Cleveland, Ohio
Powell, Wm., Co., The, Cincinnati, O

VALVES (Foot and Knee)
Beryk Co., The, 1265 W. 2nd St., Cleveland, O
Malleable Iron Fittings Co., Branford, Conn

VALVES (Oil Burning Furnace)
Powell, Wm., Co., The, Cincinnati, O

VENTILATING SYSTEMS
Hoevel Mfg. Corp., 154 Ogden Ave., Jersey City, N. J.
Industrial Air Eng. Co., 311 Perry Payne Bldg., Cleveland, Ohio
Ohio Body & Blower Co., The, Cleveland, Ohio
Pangborn Corp., P. O. Box 851, Hagerstown, Md
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VIBRATORS
Adams Co., The, 106 Iron St., Dubuque, Iowa
Arcade Mfg. Co., Dept. D, Freeport, Ill.
Beryk Co., The, 1265 W. 2nd St., Cleveland, O
Malleable Iron Fittings Co., Branford, Conn
Magnetic Mfg. Co., Milwaukee, Wis.
Tessmer Mch. & Tool Co., 285 Rivard St., Detroit, Mich.

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Foundry Supplies Mfg. Co., 2221 Orchard St., Chicago, Ill.

WAX (Core Wire)
United Compound Co., 228 Elk St., Buffalo, N. Y.

WAX (Pattern)
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Oxweld Acetylene Co., Newark, N. J.

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Oxweld Acetylene Co., Newark, N. J.

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WET PANS
National Engineering Co., Machinery Hall Bldg., 549 W. Washington St., Chicago, Ill

WHEELBARROWS
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WIRE CLEANING WHEELS
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What kind are used in your plant?

Every grain of SAND used in blasting is a STONE HAMMER. Every grain of SHOT is a STEEL HAMMER.

SAND-blasting is typical of STONE-AGE methods. SHOT blasting is the MODERN method.

Which have you adopted?

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has displaced sand as a blasting abrasive in hundreds of the most modern foundries. GLOBE SHOT costs but one half as much as sand per ton of castings cleaned. One ton will do more and better work than a carload of sand. GLOBE SHOT produces an absolutely clean metallic surface, while sand leaves a coating of dust.

Let us demonstrate to you the many other points of superiority of GLOBE SHOT over sand. Write today for sample.

The Globe Steel Company, Mansfield, Ohio

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The old fashioned method of hand screening is expensive and time wasting. Stop this inefficiency, by installing *Grand Rotary Sand Riddles*. These riddles release valuable labor for productive work, thereby increasing production and reducing expenses.

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Write for details.

The Grand Rotary Sand Riddle

The Beyer Machine Company

JACKSON, MICHIGAN, U. S. A.

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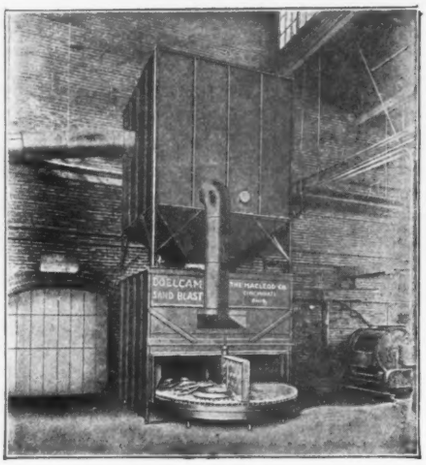

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Bogen Street, CINCINNATI, OHIO, U.S.A.

CANADIAN AGENTS { Mussens Limited Montreal—Toronto—Vancouver—Winnipeg

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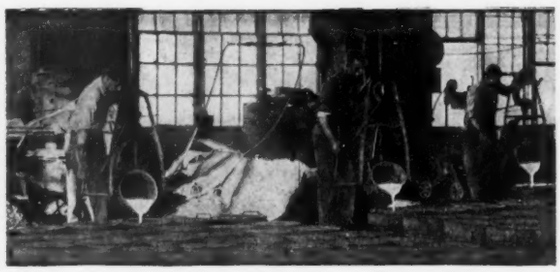
ECONOMY



Brillion 20th Century Pouring Device

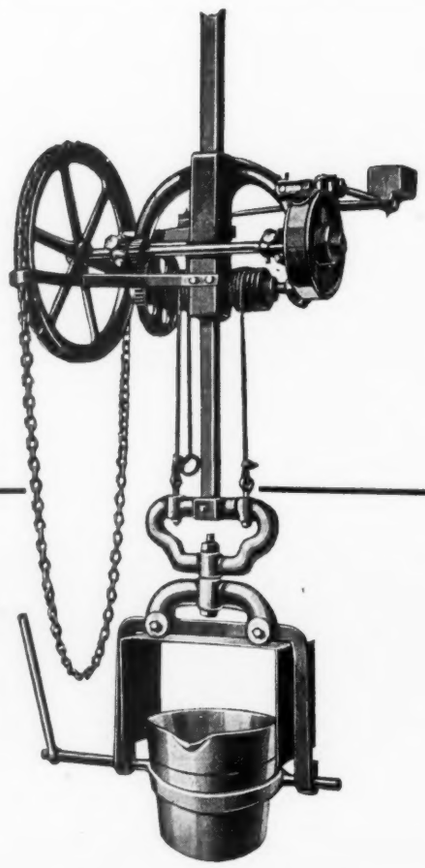
Economical Pouring, Moving —experience of users Brillion's best recommendation: molder pours large floor alone easier than by the old method with two helpers.

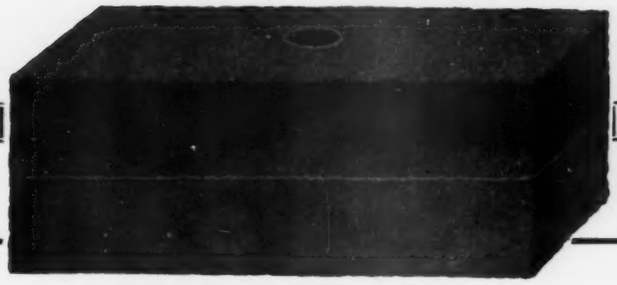
Serves purpose of hoist and traveling crane—do all your heavy moving with the Brillion.

Complete details and catalog on request.

DEPT. D.

Arcade Mfg. Co., FREEPORT, ILL., U.S.A.





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Molds produced on a Modern Molding Machine never vary—the operation is entirely mechanical; the result is a perfect mold, always. An ordinary laborer can successfully operate a Modern and treble the output of a skilled bench molder.

"Simple as a shovel" describes the Modern—a reputable company is back of it, insuring service in time of need. Complete details on request.

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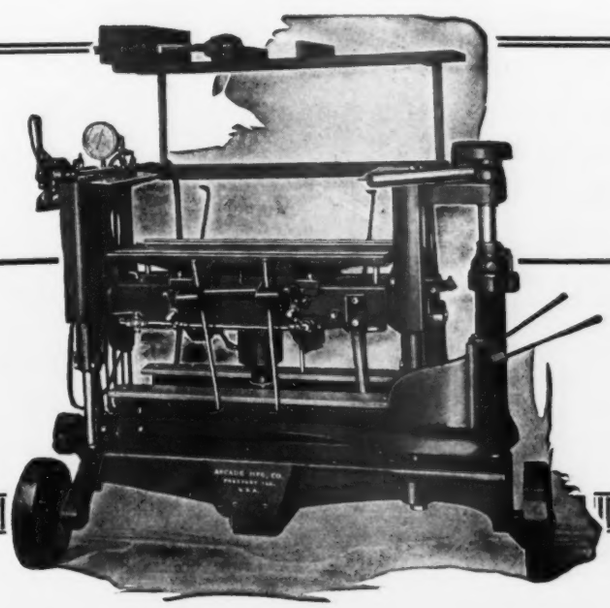

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The NEW HAVEN Self Contained Sand Blast Machine

A complete self contained sand blast rolling mill in one machine, the New Haven is without a peer in its field.

Ideally adapted to small and medium sized castings, tumbling, sand blasting and cleaning them all in one operation.

Just what you need to put a crimp in your overhead expenses—send for our ten day trial offer.

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FRONT VIEW OPEN
Dimensions of Barrel, 36 inches Diameter by 46 inches long. Floor space required six feet square.

Let us supply your "Diamond Grit"

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NEW HAVEN CONNECTICUT

HENDERSON

Tumbling Barrels are the result of nearly forty years experience in this line. This firm was the pioneer in the tumbling barrel field, and has always been in the lead in making improvements.

Another point in our favor is that our one and only line is tumbling barrel manufacture thus we are able to give our customers the products of specialists.

Our line embraces Foundry Barrels - (that is barrels especially adapted to iron and brass foundries) Wet Grinding, Tilting Oblique, Japan, and Burnishing. We also make several special types. If it's a tumbling barrel consult us.

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RADIAL BLAST

Puts the cleaner on the castings, not the barrel

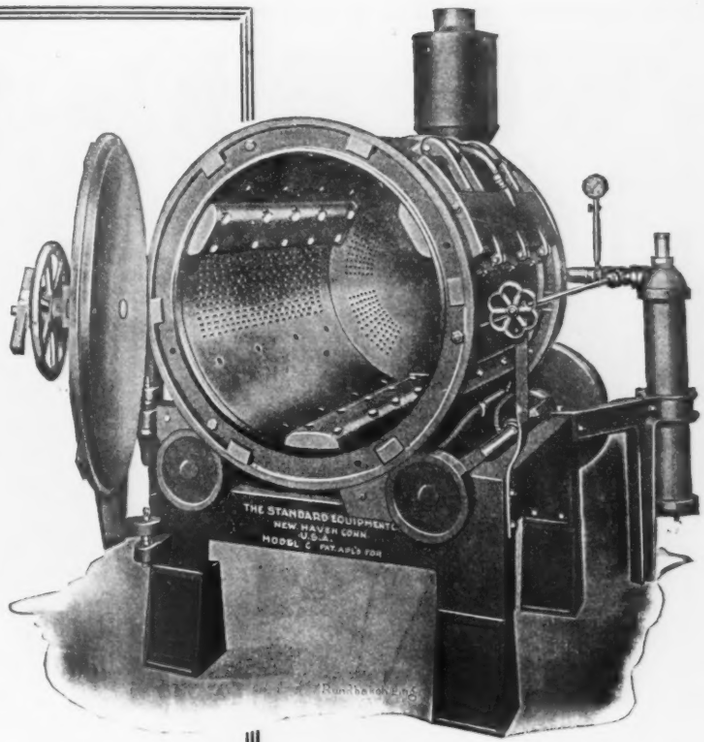
Rows and rows of nozzles accurately located, drive their cleaning blasts full on the *castings*,—not against the barrel.

The castings are really cleaned, and in a shorter time than could be accomplished by other methods

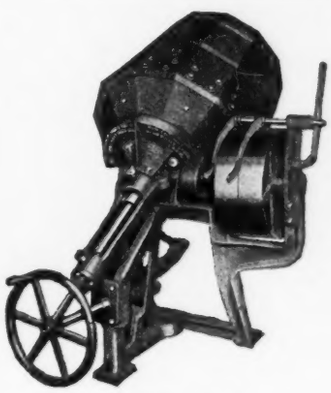
Standard Radial Blast installations always deliver more than looked-for production.

We can make reasonable delivery on all sizes ranging from 2 ft. to 5 ft. in diameter.

Write for our new bulletin.



THE STANDARD EQUIPMENT CO. NEW HAVEN, CONN. U. S. A.



MODEL M-2
TUMBLING BARREL

TUMBLING BARRELS
SPRUE CUTTERS
FLASK CLAMPS
BLOW VALVES
VIBRATORS
KNEE VALVES
SAND RIDDLES

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that Sandblast

VENTILATION SYSTEMS
that Ventilate

AIR PURIFIERS
that Purify

Simple, efficient and automatic and adapted to your own individual needs.

It will save you money and overcome your labor troubles.

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Sandblast — Tumblers — Turntables — Table Machines — Endless Belt Machines—Fans and Blowers—Dust Collectors and Purifiers.

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What is it?

Gritblast—

It's a *metallic abrasive*, that does a hundred times as much work as sand, and eliminates the necessity for storage bins and sand driers

It comes in the form of *Diamond Grit* or *Chilled Shot*—and is made by HARRISON.

It eliminates the dust, and saves greatly on transportation. Both Harrison's Diamond Grit and Harrison's Chilled Shot are especially adapted for cleaning iron, steel, malleable and aluminum castings.

Prompt shipments any size

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Use the Sellers Sand Mixer

for disintegrating lumpy sand and for thoroughly and evenly mixing all kinds of molding sand, core sand and foundry mixtures.

It does the work rapidly, effectually, and at a surprising saving in cost. Its capacity is limited only by the facilities for conveying the sand to and from it.

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AIR GUN VALVE
"JUST PRESS" THE BUTTON
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CLEANS WORK BENCHES AND MACHINE TOOLS MADE IN SIZES ⅛" TO 1"
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SANDBLAST MACHINES of EVERY DESCRIPTION

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Best on this continent for all medium and small grey iron, malleable, brass and aluminum

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for medium and heavy grey-iron castings.

Washed Silica Sand

for oil cores and steel castings.

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Just a little better than the sands you thought were best

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The Jeffery Sand Company

Dealers in
HIGH GRADE MOLDING SAND
Sand Especially Adapted for
Stove and Light Gray Iron and Malleable Work
Fine for Brass and Aluminum
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For Making Oil Cores

Requires only 50% of the usual amount of core oil when our formula is followed. Send for sample and formula.

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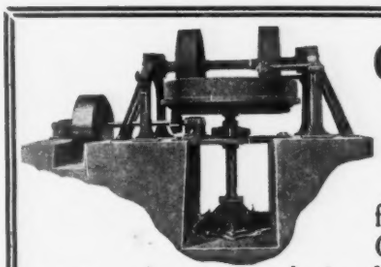

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Wet and Dry, for all Foundry and Clayworking purposes. A type and size for every use. In writing, please advise character of your material and quantity of output desired.

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We manufacture

Grinding Pans

of all types and sizes for Steel, Gray Iron and Malleable Foundries.

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"PULMOSAN" RESPIRATOR NO. 18

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When a man in your plant loses an eye, you lose the man — and production suffers.

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The Sanitary Sand Blast Helmet

ALUMINUM—made of aluminum, it is light in weight and very durable.

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STEEL-GRIP GLOVES

afford so much protection to workmen's hands that they insure a better day's work. Styles for all kinds of rough work.

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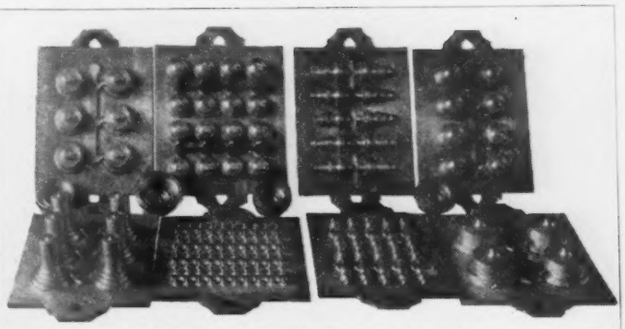

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Situated on the Airline Division of the New York Central R. R.

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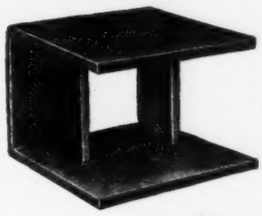

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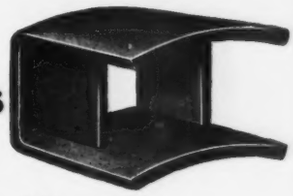
Solve some of your casting problems?
They'll do it to your SATISFACTION



A Single Piece Chaplet — Strong — Perfectly Vented.
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A binder of very great strength

Cores can stand in the mold for 72 hours without blowing or loss of strength

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Satisfaction Guaranteed Florence Ave. Ext.

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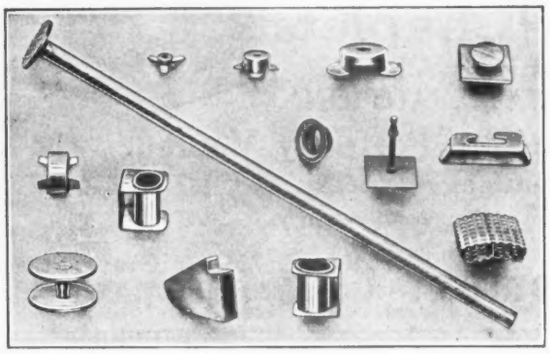

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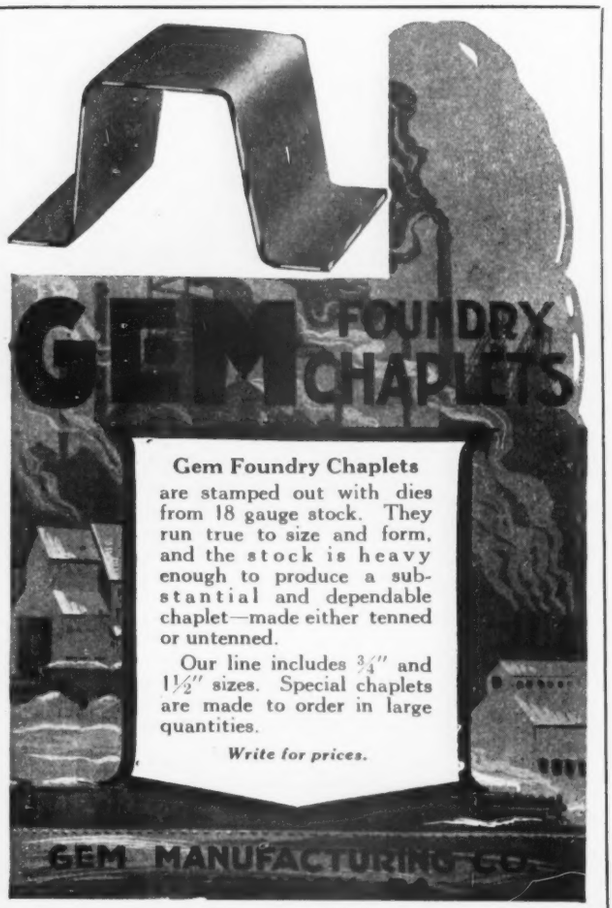
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Gem Foundry Chaplets
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$3.50 per barrel 35 years ago,

Now TEN DOLLARS for

BROWN'S PREPARED CHARCOAL PARTING

Just half the price of Mineral Parting, which many believe is very injurious to those who inhale it, while CHARCOAL, although black, is absolutely beneficial to either inhale or eat. Cures tuberculosis and stomach troubles, and improves the skin of brass or iron castings.

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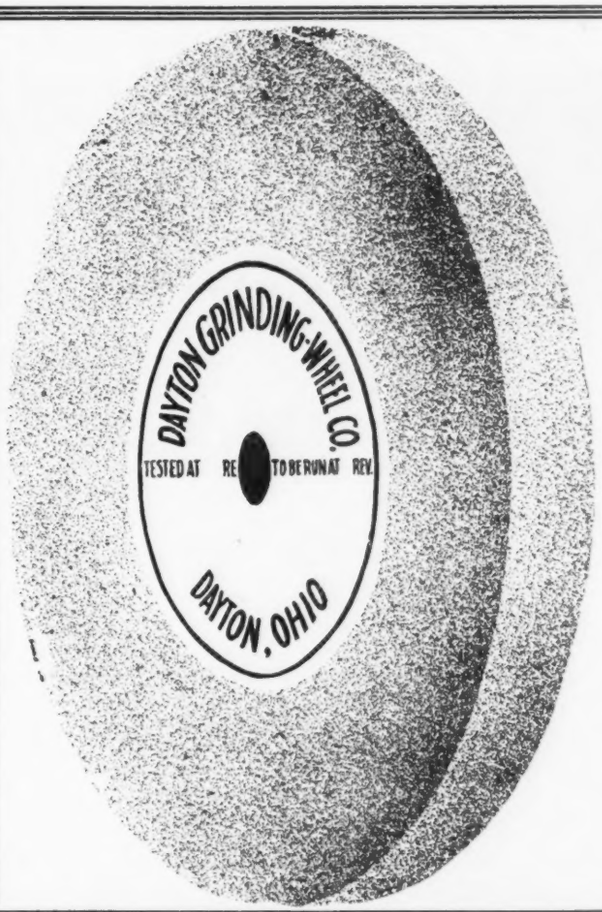

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GRINDING WHEELS

are scientifically made for long, profitable service—they are carefully graded—accurately classified—and that's why users are always glad they bought them.

Dayton Grinding Wheels cut freely, glaze slowly, every grain bites unfailingly.

You'll be well satisfied because you'll get maximum service.

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PORTABLE EMERY GRINDER
STYLES A and AA

3000 and 2700 R. P. M. Respectively

Style A Equipped with 6" x 1" face; "AA" 6" x 1¼" face Emery Wheels.

The Throttle and Forward Handles are in alignment, balancing machine on center, insuring perfect control and permitting operator to regulate speed or shut off air power without removing his hand from throttle. Adapted to Grinding Castings, Polishing, Buffing, etc. Fitted with wheel guards if required.

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Write for Illustrated Bulletin No. 35

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John MacDonald & Company, Pollokshaws, Glasgow, Scotland

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No. 1 Vibrator $10.00, Wt. 17/8 lbs.—For light match plate work.
No. 2 Vibrator $13.00, Wt. 2 7/8 lbs.—For medium match plate work.
No. 4 Vibrator $17.00, Wt. 4½ lbs.—For heavy match plate work, also for bench and tub.
No. 8 Vibrator $21.00, Wt. 7¾ lbs.—Machine vibrator. No cable furnished with this vibrator.
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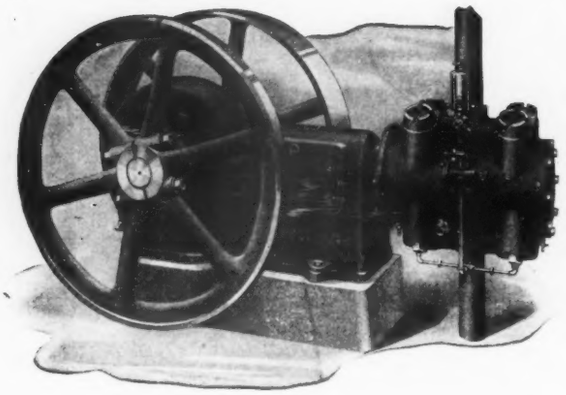
WHEN ORDERING PLEASE GIVE ACCURATE VOLTAGE (A. C. only)

Manufactured by FOUNDRY SUPPLIES MFG. CO., Chicago, Ill.
2221 Orchard Street

CABLE 5 FT. 6 IN. LONG

Continuous Air Service



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Compressed air, like any other form of power, is of little value unless it is ready to work at any and all times.

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are of the continuous service variety.

Of the belted single stage pattern, they embody standards of design and construction usually found only in much larger machines, intended for high duty.

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"WG-6" compressors are simple, sturdy and almost automatic. They provide a constant air power supply at low cost for fuel, upkeep and attendance.

Built in capacities from 50 to 470 cu. ft.

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"Spencer" Dependability Eliminates Delay

Delays caused by breakdowns and failures in air pressure, though costly, are practically unnecessary. Due to extremely wide clearances between all stationary and moving elements, and to the absence of gears or belts, the **Spencer Turbo-Compressor** maintains its efficiency permanently. It is sturdy and rugged, and thoroly reliable.

Dependability and Service are "built-in" qualities of the **Spencer Turbo-Compressor**. Over fifteen years experience in the design and manufacture of turbine compressors has placed the **"Spencer"** in the foreground of the industry.

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Solve your problem the "Spencer" way.

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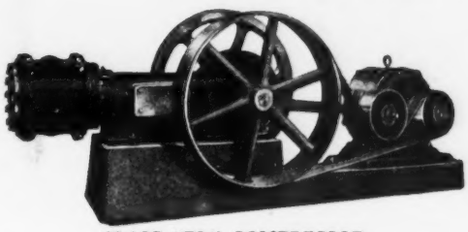
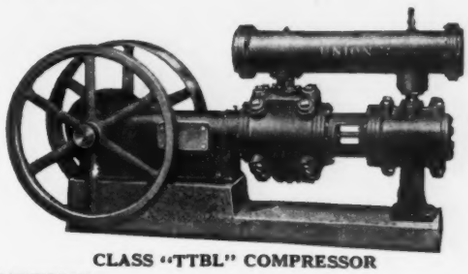
In the Foundry and Machine Shop, where dependability of the Air Compressor is important—where day-in-and-day-out service means capacity production, THERE UNION AIR COMPRESSORS recommend themselves.

ANY CAPACITY UP TO 1200 CU. FEET.



CLASS "BL" COMPRESSOR



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Union Steam Pump Co.
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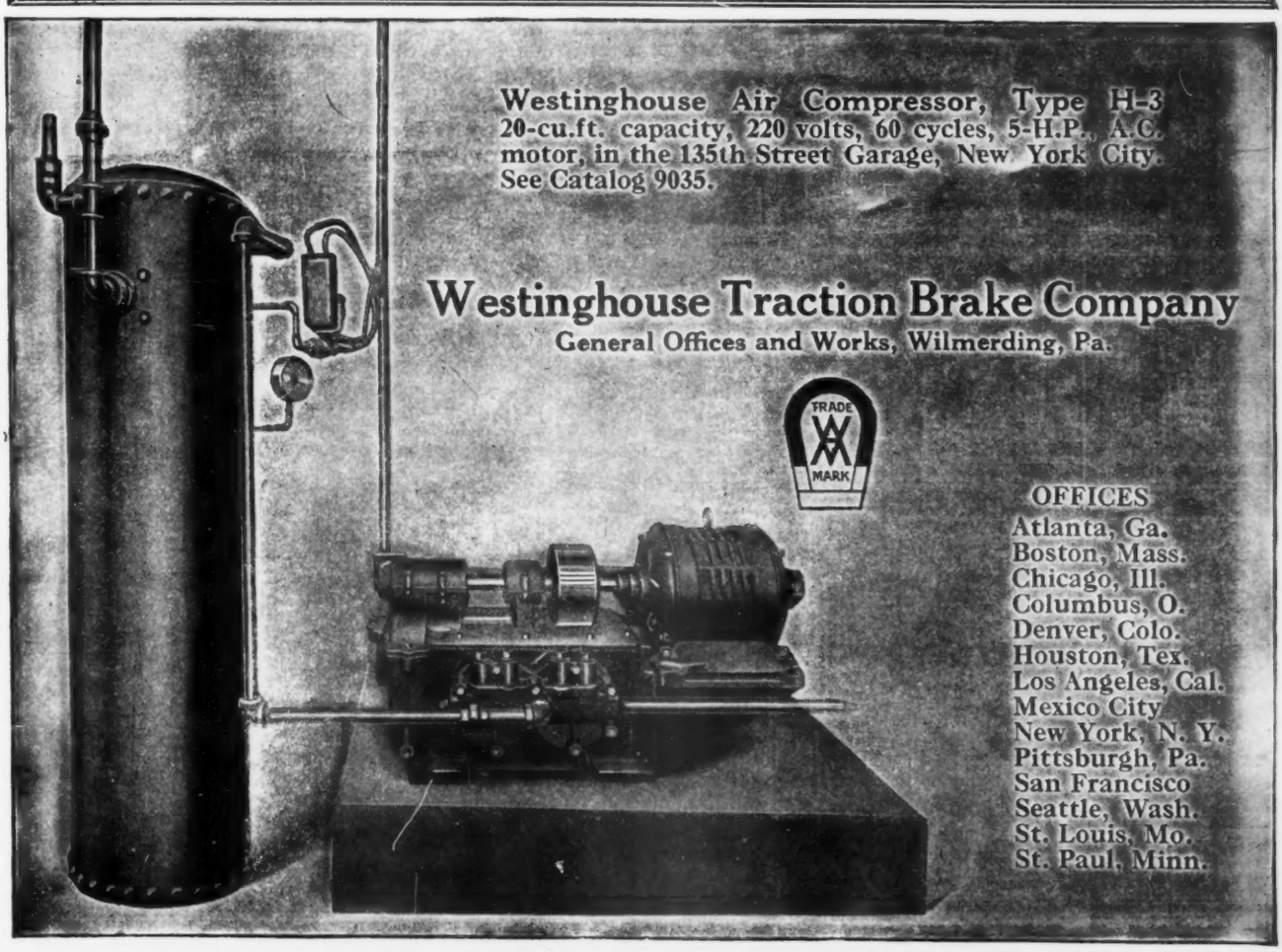

Westinghouse Air Compressor, Type H-3
20-cu.ft. capacity, 220 volts, 60 cycles, 5-H.P., A.C. motor, in the 135th Street Garage, New York City. See Catalog 9035.

Westinghouse Traction Brake Company

General Offices and Works, Wilmerding, Pa.

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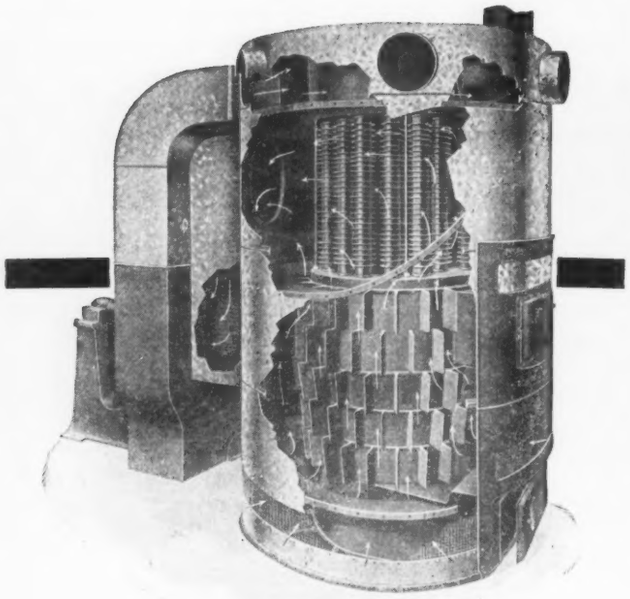

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You pay good money for all the heat in your foundry between the floor and the rafters. The only part of your heat that works however is that which goes to the working plane. Direct YOUR heat to the right spot with

The Mechanical Hot Blast Heater
"More Heat—Less Coal"

This type of heater, pictured above, is built specially to heat foundries and a great variety of other industries. A multivane fan forces the heat along the working plane warming every corner and window and insuring your workmen comfort at all times. It does this at a great saving of fuel and a maximum temperature variation of only 5°.

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Rammer Shovels

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Perfectly balanced, second growth ash handle, correctly shaped.

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Note the screw rim

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and you will understand why its success was instantaneous.

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The patent twist of FRANKLIN GAGGERS gives them four times the grip, on a body of sand, of the ordinary square or round gaggers. FRANKLIN GAGGERS hold in the sand so securely that drop-outs are impossible.

Franklin Gaggers

reduce gagger bother and expense to the minimum. Try them and see for yourself. A sample ton will convince you of their convenience and economy.

Sizes ¼"; ⅜"; ½"; and ⅝"; shipped in barrels. Leg and toe bent to any required dimensions. May we send prices?

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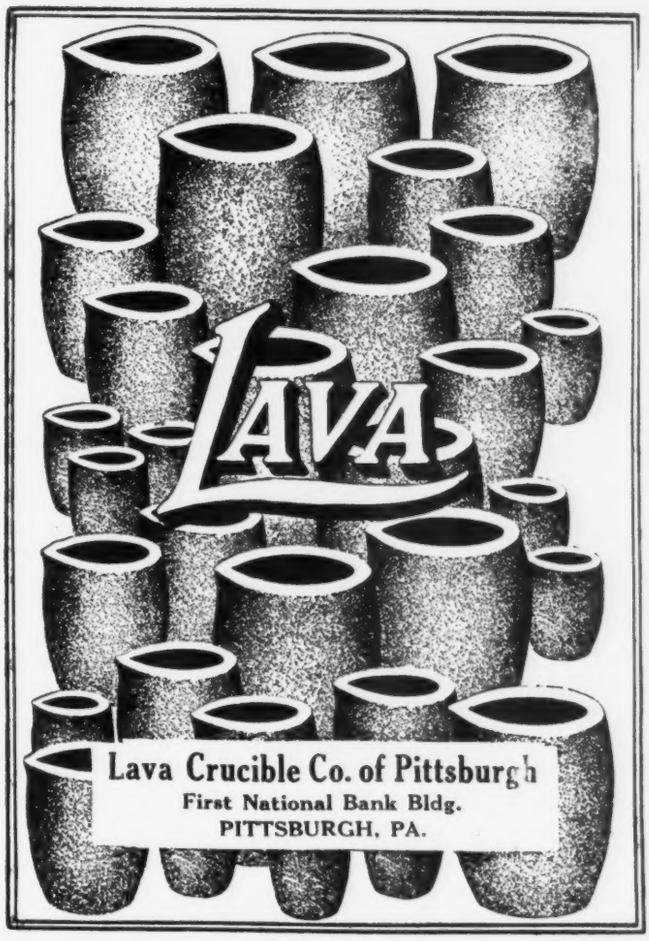
4 Times the Gripping Power of Ordinary Gaggers



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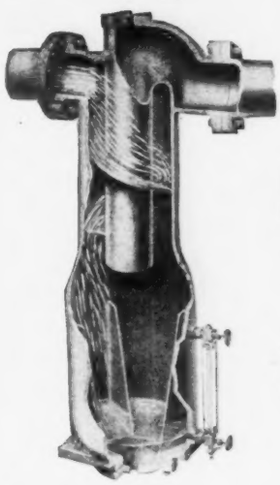
REMOVES Water from Compressed Air



Stratton Air Separator

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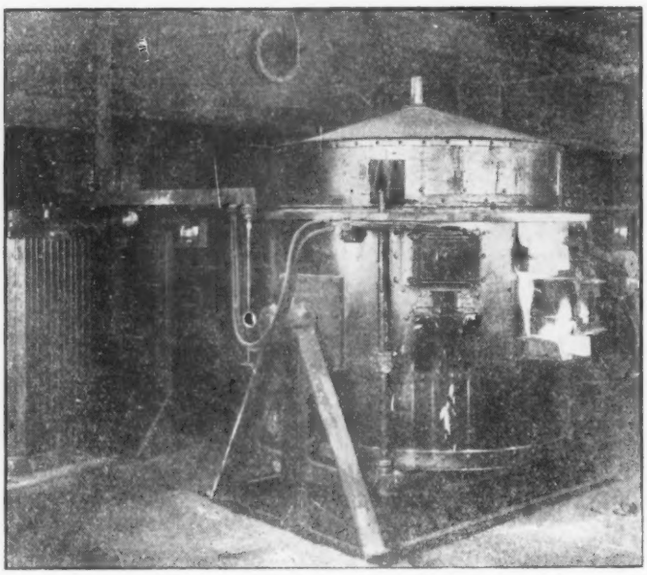
BAILY ELECTRIC FURNACES

A 75 K.W. Furnace With 750 lb. Capacity



Better brass castings are produced in this Resistance Type Unit. The furnace atmosphere is absolutely non-oxidizing and all oxides and impurities are excluded.

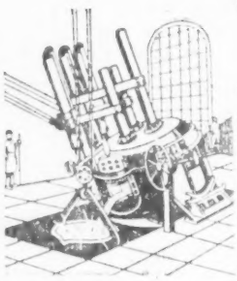
Because there are no complicated parts to get out of order this furnace offers the lowest possible upkeep cost. Power always costs less per kilowatt-hour with a Baily furnace. No operator is required to feed movable electrodes. In foundries, there are far more Baily furnaces than any other electric furnace type.

Booklet 24-B describes the 75 K.W. furnace

THE ELECTRIC FURNACE COMPANY

ALLIANCE, OHIO

Moore Rapid 'Lectromelt STEEL FURNACES



THE rapidity of operation and regularity of the heats from the Moore Furnace speed up production and thus reduce foundry costs. Freedom from cold shorts, hot cracks, blow holes and surface defects in the castings insures greater yield of merchantable product.

The mechanical design of the Moore 'Lectromelt Furnace makes for simple, practical ease and rapidity of production. The electrical design insures a uniform, evenly balanced power factor load, which is attractive to the power companies furnishing energy.

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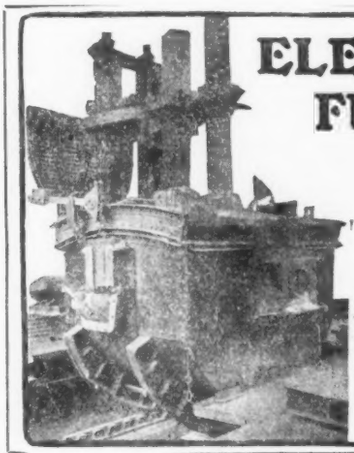
(Makers of Furnaces for Steel, Iron, Brass and Ferro-Alloys) PITTSBURGH, U.S.A.



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Send us your problems

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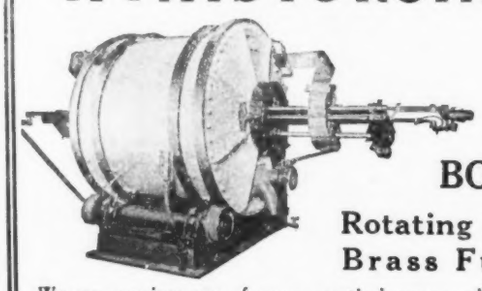
"IT PAYS TO ROTATE"



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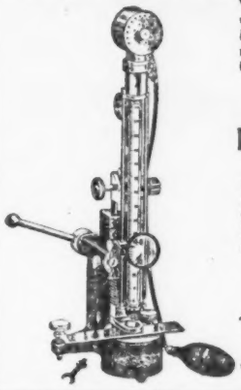

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Pamphlet free

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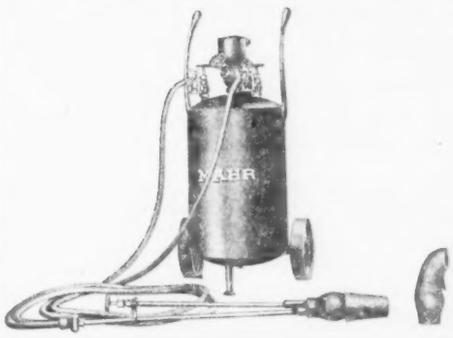

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For Cupola Lighting, Mould Drying, Preheating, etc.

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For Gray Iron Foundries

LADLE HEATERS
For Steel Foundries

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Minneapolis, Minn.

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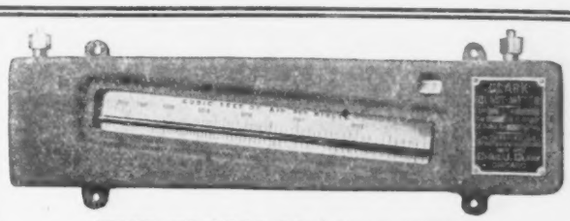
Too much air means more coke and not enough means incomplete combustion.

Determine the right amount with a Bacharach Blast Meter.

Bulletin F1, tells all about it

BACHARACH INDUSTRIAL INSTRUMENT CO.
PITTSBURGH, PA.



THE CLARK BLAST METER

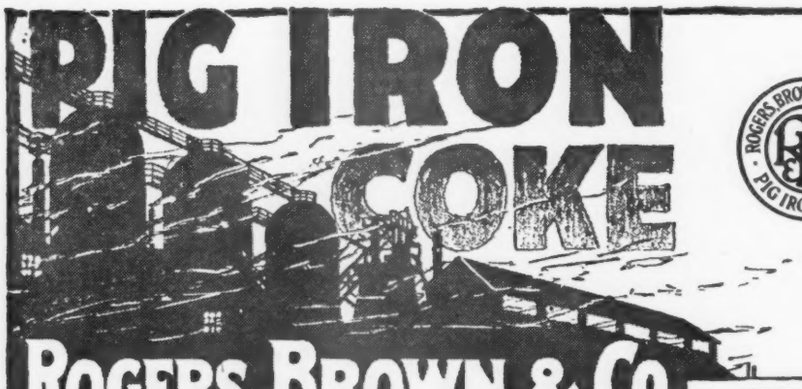
indicates the number of cubic feet of air or gas passing per minute.

The Meter is furnished in any capacity desired, each one built to order and guaranteed in every respect. Several hundred are in use in smelters, steel works, coke plants, etc.

Booklet cheerfully sent—write for it.

CHAS. J. CLARK BLAST METER CO.
Gladbrook, Iowa

PIG IRON
COKE



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"THOMAS-VANADIUM" PIG IRON

The Iron with the Long, Successful Record

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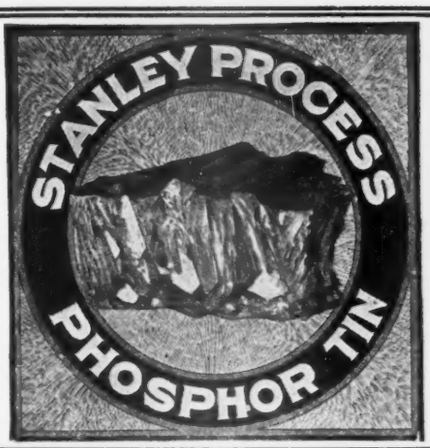

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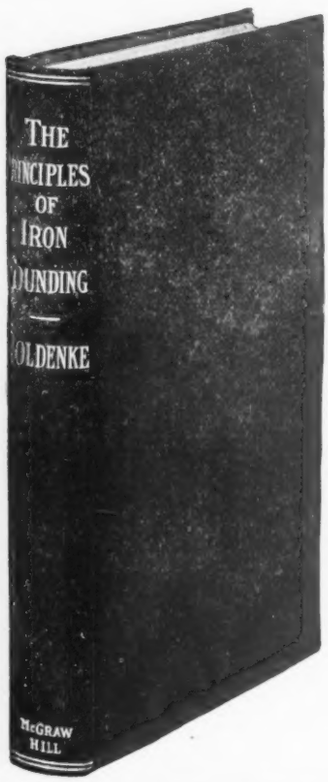

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SAND MILL
GENERATOR

One 6' diameter pan Frost Manufacturing Co. sand mill with 44 by 10" pulley in good condition—$600.00.

One 100 pound capacity Duplex low pressure Oxweld Acetylene generator with right hand chamber. Price $500.00. This generator has never been in service.

ACME STEEL
& MALLEABLE IRON WORKS, INC.,
Buffalo, N. Y.

FOR SALE—ONE NO. 5½ ROOTS BLOWER. Four No. 4 Roots Blowers. Many electric motors, exhaust fans, air compressors, etc. J. W. Adams, 130 N. 12th St., Philadelphia, Pa.

For Sale

500 Tons best grade foundry pig iron, analysis as follows:

Silicon 2.75 to 3.25
Sulphur .05 maximum
Phosphorus .40 to .70
Manganese .50 to 1.25

Make us your best offer immediate shipment, f. o. b. cars Rochester or Buffalo, N. Y.
General Railway Signal Company
Rochester, N. Y.

FOR SALE—CURTISS SINGLE I BEAM ½ TON Bridge Crane, span 25 feet, complete with trolley. Never used Northern Indiana Brass Foundry Co., Elkhart, Indiana.

For Sale

FOR SALE

Cupola Blower—General Electric 3200 Cubic feet capacity 16 oz. 220 Volt 3 Phase 60 Cycle.

Boiler—200 H.P. water tube boiler.

Cold Saw—Higley S & D Machine Co.

Locomotive—Light Saddle Tank Standard Gauge.

Squaring Shear 48" for No. 10 plate.

Whitehead & Kales Co.
Detroit, Mich.

FOR SALE:—20" MUMFORD JARRING MACHINE with 6'0" x 6' 0" Table complete. Make offer. The M. W. Kellogg Co., 117 West Side Ave., Jersey City, N. J.

FOR SALE

1—3 TON MOORE ELECTRIC FURNACE, complete with 3 ladles, brick work, and 1 car of electrodes. Price attractive. Furnace new, never installed. For further information inquire

American Industrial Engineering Co.,
53 W. Jackson Blvd., Chicago, Ill.

FOR SALE—HEAVY STOVES. SUITABLE FOR warehouses, machine and boiler shops, foundries, roundhouses, etc. E. J. Welch Foundry Co., 24th Place and Wallace St., Chicago, Ill.

Foundries Wanted, For Sale or Lease

WANTED TO BUY
MALLEABLE FOUNDRY

with a capacity of 4000 to 10,000 tons annually. This is an opportunity to dispose of a going business at an advantage and to a well established concern. Give full details, both financial and sales. All letters will be treated as confidential.

Address Box 254
THE FOUNDRY,
Cleveland, O.

MODERN EQUIPPED FOUNDRY AND MACHINE shop for sale. Located on M.C.R.R. Ideal location. Plenty of room for expansion. Address P. O. Box No. 32 Ann Arbor, Michigan.

FOUNDRY BUILDING FOR SALE, 50 X 10(concrete block and frame structure. Located i Newark, N. J. F. & H. Foundry Co., Inc., Newari N. J.

FOR SALE:—FULLY EQUIPPED JOBBING FOUNDry with capacity of ten tons per day. Located i best inland manufacturing city on Pacific Coast $15,000 cash required. Good opportunity for foundryman desiring to locate on Pacific Coast. Address Box 255, THE FOUNDRY, Cleveland, O.

Wanted

SECOND-HAND FOUNDRY EQUIPMENT WANTED Including cupolas, ladles, tumbling barrels, etc. Quote price and state condition. Address Box 302, THE FOUNDRY, Cleveland O

WANTED—UP-TO-DATE SET OF PATTERNS AND core outfit for the different sizes of soil pipe and fittings. Address Box 270, THE FOUNDRY, Cleveland, O.

WANTED—OLD COPIES OF THE FOUNDRY. WE want ten copies of THE FOUNDRY dated February, 1912. Anyone having one or more copies of this issue to sell, kindly get in touch with THE FOUNDRY, (Circulation Dept.), Cleveland, Ohio.

Miscellaneous

MR. FOUNDRYMAN:—OUR ZIPPLERS, PATENTED Tuyereage System installed in your cupola will melt iron faster with the the least amount of fuel than any other tuyereage System in existence, our written guarantee protects you from any and all losses, no comperison to our guarantee. Zipplers Patented Tuyereage System Co., Avalon, Pittsburg, Pa.

WE HAVE AN ATTRACTIVE PROPOSITION FOR any foundry that can make and sell simple heavy hardware. Grand Haven Pattern Works, Grand Haven, Mich.

BRASS CASTING CONTRACT WORK WANTED one ounce to one hundred pounds; solid or cored At present making high grade red brass. Immediate negotiations solicited. Hart Company, Williamsport Penna.

BLOWERS

1—Connersville, silent chain drive, 153 Cu. ft. Displacement.

1—Connersville, 3.3 cu. ft. displacement.

1—Connersville, 6 cu. ft. displacement.

1—No. 2 Garden City Positive Pressure.

1—Piqua, 45 cu. ft. displacement.

1—No. 4 Roots, 15 cu. ft. displacement.

1—No. 7 American Blower, fan type.

1—No. 5 Sturtevant Blower, fan type.

1—No. 9 Buffalo Blower, fan type.

All sizes of fans.

FLASKS

400 Sterling Flasks 24" x 10½" x 8 x 3.
100 " " 32" x 24" x 16 x 16.
20 " " 28" x 14" x 5 x 5.
75 Cast Iron " 20½" x 13½" x 4½" x 3½".
50 Cast Iron Flasks 16" x 14" x 4½" x 3½".

TUMBLERS

1—18" diam. x 42" long Exhaust Mill.
1—24" diam. x 48" long Exhaust Mill.
1—36" diam. x 54" long Exhaust Mill.
1—36" diam. x 66" long Exhaust Mill.

CRANES

1—3 ton, 3 motor, 220 V. D.C. 21 ft. span.
1—20 ton, 4 motor, 220 V. D.C. 34 ft. span.
2—1 ton wall cranes with runway.

STEEL CONVERTERS

1—2 TON WHITING SIDE BLOW CONVERTER, COMPLETE WITH BLOWER, STACK AND MISC. EQUIPMENT.

MOLDING MACHINES

1—Tabor Squeezer, will take 24 x 48 flask.
1—Grimes molding machine, hand operated.
1—14" x 16" Tabor Split Pattern.
2—13" x 18" Tabor Split Pattern.
1—Osborne Stripping Plate Jolt Machine.
1—No. 1 Modern—Arcade.
10—Adams Squeezers, 38" stationary.

MISCELLANEOUS EQUIPMENT

1—50 H.P. Allis Chalmers slip ring motor 220 volt, 3 ph. 60 cyc. complete with pulley, slide rail and non-reversing drum type speed regulator.

1—Saw Table.

1—½-ton Sprague Elec. Hoist, 110 V. D.C.

1—60" Swartz Brass Furnace.

1—42" Swartz Brass Furnace.

1—No. 1 Reliable Sandblast machine.

2—6" Goulds Rotary Pumps.

1—Sellers Sand Mixer.

3—7" x 3' 0" Curtis Air Hoists.

1—5" x 3' 3" Curtis Air Hoist.

2—27" Band Saws.

2—Heavy double end grinders.

1—5 ton worm geared ladle.

1—¾" yard single line bucket.

2—500 lb. Crank Drop Hammers.

Scully-Jones & Company

Railway Exchange Building **CHICAGO, ILL.**